



UNITED REPUBLIC OF TANZANIA
MINISTRY OF NATURAL RESOURCES AND TOURISM
TANZANIA FORESTRY RESEARCH INSTITUTE



3RD INTERNATIONAL TAFORI SCIENTIFIC CONFERENCE

RESTORING FOREST LANDSCAPES FOR
SUSTAINABLE DEVELOPMENT AND CLIMATE
CHANGE MITIGATION

11TH – 13TH DECEMBER 2024 | AICC | ARUSHA

PROGRAMME AND ABSTRACTS



THE 3rd INTERNATIONAL TAFORI SCIENTIFIC CONFERENCE

ON

**RESTORING FOREST LANDSCAPES FOR SUSTAINABLE
DEVELOPMENT AND CLIMATE CHANGE MITIGATION**

**HELD ON 11TH TO 13TH DECEMBER 2024, AT ARUSHA
INTERNATIONAL CONFERENCE CENTRE, ARUSHA**

PROGRAMME AND ABSTRACTS



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OUR ESTEEMED SPONSORS



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IMPORTANT INFORMATION

Venue and Dates

The 3rd International TAFORI Scientific Conference takes place at the Arusha International Conference Centre (AICC), Arusha - Tanzania, along the East African Road, from 11th to 13th December 2024.

Contacts

Headquarter, Kingolwira, Dar – Moro Highway, P.O. Box 1854, Morogoro – Tanzania.

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Conference Registration Time

Wednesday: 11th Dec. 2024:

07:30 – 17:20 hours

Thursday: 12th Dec. 2024:

07:30 – 11:55 hours

Friday: 13th Dec. 2024:

07:30 – 15:00 hours

Mobile Phone Policy

Delegates are advised to put their mobile phones either on silent mode or switched off during all Conference sessions.

Official Language

English is the official language for this Conference.

Entry Requirement for Participants from outside Tanzania

A valid passport, three-month single-entry tourist visas are available at Tanzanian Embassies in your country. For more information, please visit www.tanzaniatourism.go.tz for country specific information.

Name Badge

Your name badge serves as your entry pass to all conference sessions. Please ensure you wear it at all times during the event. Participants without badges will not be allowed into conference rooms or sessions. If you lose your badge, a replacement will be issued upon proof of your original registration.

Lost and Found

For any lost and found personal belongings, please visit the Information Desk at the registration area for assistance. We also encourage all participants to keep their items secure.



Lunch and Tea/ Coffee break

Lunch and tea/coffee is included in the registration fee and will be served daily in the conference area.

Banking

Banks and currency exchange bureaus are accessible at the airport and in major towns. Banking hours are Monday to Friday, 8:30 am to 3:00 pm, and Saturday from 8:30 am to 1:30 pm. Numerous ATMs with international financial services are available in Arusha City, including some near the conference venue at AICC.

Internet Services

Wi-Fi will be available to all delegates. Participants will be informed of Wi-Fi access points during the conference.

Electric Current

The voltage in Tanzania is 220 volts AC 50Hz. Most of the sockets require three square pin plug.

Weather

Arusha's weather at this time of year is generally sunny, with temperatures ranging between 22 and 28°C. Carrying an umbrella could be helpful, as occasional rains are possible.

Accommodation

Arusha city offers a wide range of accommodations, including five-star hotels, lodges, guest houses, and homestays. For booking assistance on accommodations, please contact the Conference Organizing committee at conference2024@tafori.or.tz or call the Secretariat Mobile Number: +255 784 404873.

Security

Tanzania is a safe and politically stable country, known for its warm and welcoming people who are always ready to assist visitors in making the most of their stay. However, as in any country, it's wise to take standard precautions: avoid walking alone at night and secure your valuables in your hotel safe. For emergencies, please report to the nearest police station or contact the Secretariat at +255 784 404873.

Kilimanjaro International Airport

Kilimanjaro International Airport, the main gateway for tourists to Tanzania's Northern Circuit, is 40 km (about one hour by car) from Arusha City. The airport offers banks, curio shops, bars, and restaurants, with regular shuttles to Arusha and Moshi and affordable taxis.



Tour Trip

For those interested in tourism, there will be a tour trip to attractive areas around Arusha. Hence, you should prepare yourself for this on the fourth day for more information, please contact the Secretariat at conference2024@tafori.or.tz or call +255 784 404873.

Safari Booking and Unique Tourism Experience in Tanzania

The conference venue is within reach of a number of attractions. The Tanzania Association of Tour Operators (TATO), representing over 256 tour operators, promotes quality tourism experiences in Tanzania. TATO is committed to upholding high standards for visitors among its members. For safari bookings or unique tourism experiences, please reach out to TATO:

P.O. Box 6162, Arusha - Tanzania
Tel: +255 2504188
Email: info@tatotz.org;
sirili@tatotz.org

First Aid and Health checkup

Participants are advised to travel with their insurance for the entire period of stay. At the conference first aid service will be provided in case of emergency. For more medical checkups, Mount Meru Referral Hospital, a government facility, is conveniently located within walking distance from the Arusha International Conference Centre. For additional assistance, please contact the Secretariat at conference2024@tafori.or.tz or call +255 784 404873.

Gemstones

Tanzanite, a stunning blue-violet gemstone unique to Northern Tanzania, can be explored at the Tanzanite Experience Museum, where visitors can learn its history and purchase certified jewelry. Arusha's Cultural Heritage Centre (figure 1) is another must-see, featuring impressive sculptures and offering jewelry, handicrafts, and fine art. For assistance with visiting these attractions, please stop by the exhibition area at the conference or contact the Secretariat at conference2024@tafori.or.tz or call +255 784 404873.





Figure 1: Arusha's Cultural Heritage Centre



MESSAGE FROM THE DIRECTOR GENERAL, TANZANIA FORESTRY RESEARCH INSTITUTE (TAFORI)



Dear Colleagues and Honored Guests,

It is my great pleasure to welcome you to the 3rd International TAFORI Scientific Conference on Restoring Forest Landscapes for Sustainable Development and Climate Change Mitigation. This conference, scheduled for December 11-13, 2024, at the Arusha International Conference Centre in Tanzania, is an invaluable opportunity to bring together global forestry and beekeeping stakeholders to share knowledge, engage in meaningful discussions, and set the path forward for our sectors.

This year's conference covers eight critical sub-themes that span Financing forestry and beekeeping; Forest degradation, biodiversity conservation and nature based solutions; Innovations and technologies in forest and beekeeping industries; Forest and bee products value chains under climate change scenarios; Gender perspective in forest and beekeeping industries; Green and blue economy policy and governance; Clean energy solutions for sustaining forest landscapes; and Forest landscape restoration governance and management. Each theme is carefully chosen to reflect the most pressing issues facing our field today and provides a structured forum for exploring innovative strategies, policies, and technologies that can drive sustainable growth.

Our expected outcomes are ambitious yet achievable from the presentation of cutting-edge research and the showcasing of industry innovations to the publication of insightful papers and proceedings. This conference will contribute not only to the forestry and beekeeping sectors but also to broader economic development and poverty reduction efforts by stimulating new partnerships and highlighting research areas that demand further exploration.

With over 400 participants from around the world, we have representation across academia, industry, government, and international organisations. This broad participation reflects the diversity and depth of expertise needed to tackle our shared environmental and economic challenges. I extend my sincere gratitude to



both Management of the Ministry of Natural Resources and Tourism (MNRT) and Tanzania Forestry Research Institute (TAFORI) for their invaluable support, as well as to the dedicated 21-members of organizing committee whose efforts have been instrumental in making this conference a reality.

Together, let us harness the power of collaboration, innovation, and policy guidance to ensure that the forestry and beekeeping sectors continue to play a vital role in sustainable development. I look forward to the productive sessions and impactful discussions that lie ahead. On behalf of TAFORI Management, I warmly welcome you and wish you productive and successful experience at the 3rd International TAFORI Scientific Conference, 2024.

Thank you! *Ahsante Sana!*



Dr. Revocatus P. Mushumbusi
DIRECTOR GENERAL



1.0 THE CONFERENCE

1.1 Overview of the Conference

This 3rd International TAFORI Scientific Conference on Restoring Forest Landscapes for Sustainable Development and Climate Change Mitigation is a three (3) days' conference that is held from 11th to 13th December, 2024 at Arusha International Conference Centre (AICC), Arusha, Tanzania. The conference brings together forestry and beekeeping stakeholders from different parts of the world for knowledge sharing, deliberating and set future needs for Forestry and Beekeeping Sector.

The Conference has eight (8) sub themes as follows:

- i. Financing forestry and beekeeping;
- ii. Forest degradation, biodiversity conservation and nature based solutions;
- iii. Innovations and technologies in forest and beekeeping industries;
- iv. Forest and bee products value chains under climate change scenarios;
- v. Gender perspective in forest and beekeeping industries;
- vi. Green and blue economy policy and governance;
- vii. Clean energy solutions for sustaining forest landscapes; and
- viii. Forest landscape restoration governance and management.

Expected outputs from the conference are: Research findings presented, exhibitions displayed; papers published; research findings disseminated; proceedings produced in both soft and hard copies. The conference is also expected to stimulate and elevate the contribution of forest and beekeeping sector to the economy and people's livelihoods; bring together scientists, innovators and students from universities and industries, high level policy and decision-makers, development partners, diplomatic community, business community and practitioners from different parts of the world to share state-of-the-art information; identification of areas requiring further research as well as key policy measures to enhance the contribution of forests, woodlands and beekeeping to economic development and poverty reduction. More than 400 participants drawn from different parts of the world are in attendance. The conference has been supported by the Government of the United Republic of Tanzania via Ministry of Natural Resources and Tourism (MNRT) and Tanzania Forestry Research Institute (TAFORI).



1.2 Organizing Committee

The organizing committee is comprised of 21 forestry and beekeeping stakeholders from different organisations as indicated in **Section 5.0**

1.3 Tentative Workshop Programme

Tentative Programme for the 3rd International TAFORI Scientific Conference on Restoring Forest Landscapes for Sustainable Development and Climate Change Mitigation, 11th – 13th December 2024, Arusha International Conference Centre, Arusha, Tanzania

MUDA	TUKIO	WAHUSIKA
SIKU YA KWANZA: 11 DISEMBA 2024		
01:30 – 11:50		
KIPINDI NAMBA 1: SHEREHE YA UFUNGUZI WA KONGAMANO		
Mshereheshaji: Bw. Shabani Kisu		
01:30 – 03:00	Washiriki kuwasili, kujisajili na kupata chai	Itifaki
03:00 – 03:05	Mgeni Rasmi Kuwasili katika viwanja vya AICC	Itifaki
03:05 – 03:20	Mgeni Rasmi kukagua Mabanda ya Maonesho	Mhe. Balozi Dkt. Pindi Hazara Chana (Mb), Waziri wa Maliasili na Utalii
03:20 – 03:30	Mgeni Rasmi kuingia ukumbini na kuimba Wimbo wa Taifa na Wimbo wa Afrika Mashariki	Brasi Bendi
03:30 – 03:35	Dua na Sala kutoka kwa Viongozi wa Kidini	Bw. Shabani Kisu
03:35 – 03:40	Utambulisho	Dkt. Revocatus Mushumbusi - Mkurugenzi Mkuu TAFORI



MUDA	TUKIO	WAHUSIKA
03:40 – 03:45	Salaam za Mkoa wa Arusha	Mhe. Ndugu Paul Makonda, Mkuu wa Mkoa wa Arusha
03:45 – 03:50	Salaam za Bunge - Kamati ya Kudumu ya Bunge ya Ardhi, Maliasili na Utalii	Mhe. Thimotheo Mnzava, Mwenyekiti wa Kamati
03:50 – 03:55	Salaam kutoka kwa Bodi ya Wakurugenzi ya Taasisi ya Utafiti wa Misitu Tanzania (TAFORI)	Prof. Verdiana Grace Masanja – Mwenyekiti wa Bodi ya Wakurugenzi - TAFORI
03:55 – 04:00	Maelezo kuhusu Kongamano la Tatu la Kimataifa la Sayansi	Dkt. Revocatus Mushumbusi - Mkurugenzi Mkuu TAFORI
04:00 – 04:10	Salamu za Waziri na kumkaribisha Mgeni Rasmi	Mhe. Balozi, Dkt. Pindi Hazara Chana – Waziri wa Maliasili na Utalii
04:10 – 04:40	Hotuba ya Mgeni Rasmi kufungua Kongamano la Tatu la Kimataifa la Kisayansi la TAFORI	Mhe. Dkt. Philip Isdor Mpango, Makamu wa Rais, Jamhuri ya Muungano wa Tanzania
04:40 – 04:50	Kutoa Tuzo kwa Wadhamini	Mgeni Rasmi
04:50 – 04:55	Picha za Pamoja	Bw. Shabani Kisu
04:55 – 05:00	Mgeni Rasmi kuondoka ukumbini	Itifaki
05:00 – 12:00	Kongamano kuendelea	Bw. Abdallah Henku



TIME	ACTIVITY	RESPONSIBLE PERSON/AUTHORS
DAY ONE 11TH DECEMBER 2024		
07:30 – 11:50 SESSION 1: OPENING CEREMONY Moderator: - Mr. Shabani Kisu		
07:30 – 09:00	Registration and Morning tea/coffee-Breakfast	Protocol
09:00 – 09:05	Arrival of the Guest of Honor at AICC	Protocol
09:05 – 09:20	Guest of Honor Official Inauguration of the Exhibition	Hon. Ambassador. Dr. Pindi Hazara Chana (MP) Minister of Natural Resources and Tourism (MNRT)
09:20 – 09:30	Guest of Honor arrival in the Conference, National anthem, East Africa anthem	Brass Band
09:30 – 09:35	Prayers and supplications from religious leaders	Mr. Shabani Kisu
09:35 – 09:40	Introductions of the dignitaries and Conference participants (Nationality/ Institutional/ Sector representation) and acknowledging online participants	Dr. Revocatus Mushumbusi – DG TAFORI
09:40 – 09:45	Greetings from Arusha Region Commissioner	Hon. Paul Makonda, Regional Commissioner of Arusha



09:45 – 09:50	Greetings from Parliament - Parliamentary Standing Committee on Land, Natural Resources and Tourism	Hon. Thimotheo Mnzava (MP), Chairman of the Parliamentary Standing Committee on Land, Natural Resources and Tourism
09:50 – 09:55	Greetings from the Board of Directors of Tanzania Forestry Research Institute (TAFORI)	Prof. Verdiana Grace Masanja, Chairperson of TAFORI Board of Directors
09:55 – 10:00	Brief presentation - Objectives of the 3 rd International TAFORI Scientific Conference on Restoring forest landscapes for sustainable development and climate change mitigation	Dr. Revocatus Mushumbusi – DG TAFORI
10:00 – 10:10	Remarks from the Minister, followed by a request to the Guest of Honor to Officially open the 3 rd International TAFORI Scientific Conference	Hon. Ambassador. Dr. Pindi Hazara Chana (MP) Minister of Natural Resources and Tourism (MNRT)
10:10 – 10:40	Official Opening of the 3 rd International TAFORI Scientific Conference on Restoring forest landscapes for sustainable development and climate change mitigation	Hon. Dr. Philip Isdor Mpango, Vice President, United Republic of Tanzania
10:40 – 10:50	Awarding trophies to sponsors	Guest of Honor
10:50 – 10:55	Group Photo	Mr. Shabani Kisu
10:55 – 11:00	Guest of Honor departure from the conference	Protocol
END OF SESSION 1		



TECHNICAL PRESENTATIONS

Lead Facilitator/Moderator: Mr. Abdallah Henku

Rapporteurs: Dr. Numan S. Amanzi, Mr. Milkajane J. Sangiwa, Mr. Joshua Maguzu, Mr. Adam Shemahonge, Mr. James Lyamuya and Ms. Nezia Byakugila

11:00 – 12:10

SESSION 2: KEYNOTE ADDRESS 2

VENUE: Simba Hall

SESSION REPPORTEURS: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa

11:00 – 11:25	<p>Theme 1: Financing Forest and Beekeeping activities in Tanzania</p> <p>Keynote address: Status of forest and beekeeping financing in Tanzania</p>	Dr. Lawrence Mbwambo
11:25 – 11:50	<p>Theme 2: Forest degradation, biodiversity conservation and nature based solutions</p> <p>Keynote Address: The trouble with invasive non-native trees in East Africa</p>	Dr. Urs Schaffner
11:50 – 12:10	Discussions (Questions and Answers)	Mr. Abdallah Henku

END OF SESSION 2

12:10 – 12:15	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS	
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12:15 – 13:20


PARALLEL SESSIONS 3, 4 & 5

TRACK THEME	<p>Theme 1: Financing forestry and beekeeping</p> <p>Theme 5: Gender perspective in forest and beekeeping industries</p>	<p>Theme 2: Forest degradation, biodiversity conservation and nature based solutions</p>	<p>Theme 3: Innovations and technologies in forest and beekeeping industries</p>
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SESSIONS	Venue: Room K 222 Session 3 Chair: Ms. Merystera Shirima Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	Venue: Simba Hall Session 4 Chair: Dr. William Kindeketa Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Venue: Room K 204 Session 5 Chair: Dr. Elisha E. Njoghomi Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila
12:15 – 12:30	Financing reforestation and beekeeping projects to accelerate landscape and ecosystem restoration in Tanzania Mbwambo, J.R	Assessment of Nature based Solutions in Kilifi mangrove ecosystems in Kenya Mwangeka, N	Temporal and spatial pattern of forest fires in the Tongwe west local authority forest reserve (2003-2023), Tanzania Nyamaka, K
12:30 – 12:45	Gender perspective in beekeeping value chain in Kitui County, Kenya Mwalewa, S	Woody vegetation structure, floristic composition and species richness along the elevation gradient of Mt. Meru, Tanzania Lasway, J.V	The first record of honey bee parasitism by tachinid flies (Tachinidae) in Tanzania Mduda, C
12:45 – 13:00	Women's engagement in the timber value chain nodes in East African Community Msalilwa, U.L	Status of invasive <i>Prosopis juliflora</i> and its ecological impacts on native forbs and grasses in northern Tanzania Meela, F	Evaluation of penetration, retention and distribution of chemical preservatives in various wooden pole classes in Mufindi District, Tanzania



			Mweta, M.J
13:00 – 13:20	Discussions (Questions and Answers)	Discussions (Questions and Answers)	Discussions (Questions and Answers)
END OF SESSIONS 3, 4 & 5			
13:20 – 14:00			LUNCH BREAK
14:00 – 14:35 SESSION 6: KEYNOTE ADDRESS 3 VENUE: Simba Hall SESSION REPPORTEURS: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa			
14:00 – 14:25	Theme 3: Innovations and technologies in forest and beekeeping industries Keynote Address: Innovations in machine learning for forest restoration and climate change mitigation		Prof. Verdiana Masanja
14:25 – 14:35	Discussions (Questions and Answers)		Mr. Abdallah Henku
END OF SESSION 6			
14:35 – 14:40	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS		
14:40 – 15:15 PARALLEL SESSIONS 7, 8 & 9			
TRACK THEME	Theme 4: Forest and bee products value chains under climate change scenarios	Theme 2: Forest degradation, biodiversity conservation and nature based solutions	Theme 3: Innovations and technologies in forest and beekeeping industries
SESSIONS	Venue: Room K 222 Session 7 Chair:	Venue: Simba Hall	Venue: Room K 204 Session 9 Chair:




	Mr. Stephen E. Msemu Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	Session 8 Chair: Mr. Fransis Laswai Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Dr. Zacharia Lupala Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila
14:40 – 14:55	Beekeepers' perception on arrangement supports for beekeeping activities in Tanzania Richard, A.K	Impacts and severity of pests and diseases affecting conservation of mangrove forests in Kenya. Nyahe, S	Innovative documentation of nature-based solutions for enhanced technology transfer in horn of Africa Wanjiku, J
14:55 – 15:10	Promoting high bee diversity in Afro tropical drylands: The impact of agriculture intensification with seasonal fallow lands in Northern Tanzania Lasway, J.V	Demonstrating nature-based solutions in the Mindu Dam Catchment area: The case of agroforestry in Morogoro, Tanzania van Haeff, R	Innovation and technology in forest and beekeeping industries: Mau forest, Kenya Ngugi, S.K
15:10 – 15:15	Discussions (Questions and Answers)	Discussions (Questions and Answers)	Discussions (Questions and Answers)
END OF SESSIONS 7, 8 & 9			
15:15 – 15:30	Wrap up Day One and Logistics if any		Mr. Abdallah Henku/ Dr. Chelestino Balama



<p>15:30 – 16:00</p>	<p>Word from sponsors Tanzania Forest Services Agency (TFS), Tanzania Forest Fund (TaFF), Ngorongoro Conservation Area Authority (NCAA), Tanzania National Parks (TANAPA), World Wide Fund for Nature (WWF) – Tanzania, USAID, Beekeeping Value Chain Support (BEVAC), Tanzania Broadcasting Corporation (TBC), Gatsby Africa, Finish Embassy, Sun king, Tanzania Wildlife Authority (TAWA), Tanzania Wildlife Research Institute (TAWIRI), Tanzania Association of Tour Operators (TATO), United Trust of Tanzania - Asset Management and Investor Services (UTT-AMIS), Beekeeping Training Institute (BTI), Jane Goodall Institute, College of African Wildlife Management (CAWM), Zoologische Gesellschaft Frankfurt, Kilombero Valley Teak Company (KVTC).</p>	<p>Mr. Abdallah Henku</p>
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<p>16:00 – 16:20</p>		<p>TEA/COFFEE BREAK</p>
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<p>19:00 – 20:30</p>		<p>NETWORKING & DINNER</p>
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END OF DAY ONE


DAY TWO 12TH DECEMBER 2024

<p>07:30 – 08:30</p>	<p>Registration</p>	<p>Secretariat</p>
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08:30 – 09:05
SESSION 10: KEYNOTE ADDRESS 4
VENUE: Simba Hall
SESSION REPPORTEURS: Mr. Joshua Maguzu and Mr. Adam Shemahonge

08:30 – 08:35	Announcements and Reflection on Day one		Mr. Abdallah Henku/ Dr. Chelestino Balama
08:35 – 09:00	Theme 4: Forest and bee products value chains under climate change scenarios Keynote Address: Forest and bee products value chains under climate change scenarios Online Presentation		Dr. Mike Allsopp
09:00 – 09:10	Discussions (Questions and Answers)		Mr. Abdallah Henku
END OF SESSION 10			
09:10 – 09:15	BREAK TO RESPECTIVE VENUES FOR PARALEL SESSIONS		
09:10 – 10:20 PARALLEL SESSIONS 11, 12 & 13			
TRACK THEME	Theme 4: Forest and bee products value chains under climate change scenarios	Theme 2: Forest degradation, biodiversity conservation and nature based solutions	Theme 3: Innovations and technologies in forest and beekeeping industries
SESSIONS	Venue: Room K 222 Session 11 Chair: Mr. Stephen E. Msemu Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Venue: Simba Hall Session 12 Chair: Dr. Zackaria J. Lupala Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	Venue: Room K 204 Session 13 Chair: Dr. Joseph Makero Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila



<p>09:15 – 09:30</p>	<p>Types, sizes, and spatial distribution of beehives in Tanzania: implications for honey production</p> <p>Lukiko, S.B</p>	<p>Variation of soil properties under different site classes of <i>Pinus patula</i> stands at Sao Hill and Shume forest plantations in Tanzania</p> <p>Maguzu, J</p>	<p>A systematic mechanism for reporting illegal activities in the eastern arc mountains of Tanzania</p> <p>Balama, C</p>
<p>09:30 – 09:45</p>	<p>Chances and challenges of apitourism in Tanzania</p> <p>Krausa, K</p>	<p>Unutilised tourism potentials in the remaining natural patches of Mufindi District, Tanzania</p> <p>Kindeketa, W.K</p>	<p>Potential of geospatial technologies in mechanized timber harvesting planning at Sao Hill Forest Plantation, Tanzania</p> <p>Temba, G.P</p>
<p>09:45 – 10:00</p>	<p>Determinants of pricing for sustainable honey production among bee-keepers in Tanzania</p> <p>Tonya, E</p>	<p>Productivity of <i>Pinus patula</i> (Schltdl & Cham) in first and second rotations at Sao Hill Forest plantation in Iringa. Tanzania</p> <p>Laswai, F</p>	<p>Antibacterial activity of Hydrogen Peroxide-Free Apis mellifera honey from selected vegetation types in Tanzania</p> <p>Lukiko, S</p>
<p>10:00 – 10:20</p>	<p>Discussions (Questions and Answers)</p>	<p>Discussions (Questions and Answers)</p>	<p>Discussions (Questions and Answers)</p>
<p>END OF SESSIONS 11, 12 & 13</p>			
<p>10:20 – 10:30</p>	<p>POSTER PRESENTATIONS & EXHIBITIONS</p>		
<p>10:30 – 10:50  TEA/COFFEE BREAK</p>			




10:50 – 11:15 SESSION 14: KEYNOTE ADDRESS 5 VENUE: Simba Hall SESSION REPPORTEURS: Mr. Joshua Maguzu and Mr. Adam Shemahonge			
10:50 – 11:05	Theme 5: Gender perspective in forest and beekeeping industries Keynote Address: An overview of gender perspective in forest and beekeeping industries	Prof. Suzana Augustino	
11:05 – 11:15	Discussions (Questions and Answers)		Mr. Abdallah Henku
END OF SESSION 14			
11:15 – 11:20	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS		
11:20 – 13:05 PARALLEL SESSIONS 15, 16 & 17			
TRACK THEME	Theme 4: Forest and bee products value chains under climate change scenarios	Theme 2: Forest degradation, biodiversity conservation and nature based solutions	Theme 3: Innovations and technologies in forest and beekeeping industries
SESSIONS	Venue: Room K 222 Session 15 Chair: Mr. Daniel C. Pancras Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Venue: Simba Hall Session 16 Chair: Dr. Elisha E.Njoghomi Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	Venue: Room K 204 Session 17 Chair: Dr. Eliezeri Sungusia Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila



<p>11:20 – 11:35</p>	<p>Stingless bee honey harvesting, processing, storage and compliance to quality standards in Tanzania</p> <p>Mduda, C</p>	<p>Status of Mangrove degradation in mida creek ecosystem, Kenya</p> <p>Nadir, S</p>	<p>Simulation of stand dynamics for miombo woodlands in Kitulangalo Forest Reserve, Morogoro, Tanzania</p> <p>Njoghomi, E.E</p>
<p>11:35 – 11:50</p>	<p>Influence of vegetation on the physicochemical properties and sensory characteristics of honey produced by the western honeybee, <i>Apis mellifera</i> L in Tanzania</p> <p>Lukiko, S.B</p>	<p>Identification of key soil quality indicators for predicting mean annual increment in <i>Pinus patula</i> forest plantations in Tanzania</p> <p>Maguzu, J</p>	<p>Strengthening integrated Agroforestry in East Africa: A climate-smart approach for addressing decreasing yields, unstable markets, and unpredictable weather for smallholder farmers</p> <p>Gwegime, J.Y</p>
<p>11:50 – 12:05</p>	<p>Mushroom value chain development and forest conservation in Western Tanzania</p> <p>Bloesch, U</p>	<p>Carbon for conservation: Harnessing REDD+ to address forest loss, degradation and biodiversity conservation in Tanzania</p> <p>Kilimba, A</p>	<p>Four new Tanzanian plant species of the genus <i>Sansevieria</i> (Family Asparagaceae), threatened in the wild</p> <p>Mollel, N.P</p>
<p>11:05 – 12:20</p>	<p>A review of honey bee gut microbiota characterization and genomics in Africa</p> <p>Newa, N</p>	<p>Bee diversity and distribution in a protected area at Mulele Hills Forest Reserve in Katavi Region, Tanzania</p> <p>Mtuy, E. T</p>	<p>Dilemma for the Sustainability of Wood-Based Industries in Tanzania</p> <p>Balama, C</p>




11:20 – 12:35	Community awareness on Propolis production and use for its promotion to support restoration of forest resources in Tanzania Kagosi, P	Do forests and woodlands on village land forest reserves in Tanzania vanish? Empirical evidence from Ruvuma Transboundary Landscape Amanzi, N.S	Application of computer simulation technique to optimize furniture production system Mwamakimbullah, R
12:35 – 13:05	Discussions (Questions and Answers)	Discussions (Questions and Answers)	Discussions (Questions and Answers)
END OF SESSIONS 15, 16 & 17			
13:05 – 14:00			LUNCH BREAK
14:00 – 14:35 SESSION 18: KEYNOTE ADDRESS 6 & 7 VENUE: Simba Hall SESSION REPPORTEURS: Mr. Joshua Maguzu and Mr. Adam Shemahonge			
14:00 – 14:25	Theme 8: Forest landscape restoration governance and management Keynote Address: Harnessing the role of forest and farm producers in accelerating landscape restoration: A case of dryland and sustainable landscape Impact programme around Miombo woodland of Tanzania.		Prof. Dos Santos Silayo
14:25 – 14:35	Discussions (Questions and Answers)		Mr. Abdallah Henku
END OF SESSION 18			
14:35 – 14:40	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS		



14:40 – 15:35 PARALLEL SESSIONS 19, 20 & 21			
TRACK THEME	Theme 6: Green and blue economy policy and governance	Theme 2: Forest degradation, biodiversity conservation and nature based solutions	Theme 3: Innovations and technologies in forest and beekeeping industries
SESSIONS	Venue: Room K 222 Session 19 Chair: Dr. Christopher Mduda Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Venue: Simba Hall Session 20 Chair: Mr. Fransis Laswai Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	Venue: Room K 204 Session 21 Chair: Dr. William Kindeketa Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila
14:40 – 14:55	Enhanced efficiency of operations in the sawn timber value chains: A move to support the economy, curb deforestation and support climate change mitigation initiatives in Tanzania Mwamakimbullah, R	Population status and economic potential of high-valued indigenous timber species in Tanzania: A case study of <i>Pterocarpus tinctorius</i> , <i>Osyris lanceolata</i> , and <i>Bobgunnia madagascariensis</i> in Tanzania Maduka, M. S	A satellite-based monitoring deforestation of thickets ecosystem of Semi-Arid area of Tanzania John, E




14:55 – 15:20	Overview of the Tanzania’s forest sector contribution to economy, emerging challenges, opportunities and way forward Ngaga, Y.M	Integrated landscape management to address woody invasion around Lake Natron, Tanzania Xavery, D	Mixed hive systems to enhance stocking and management of bee colonies in different forest landscapes of Tanzania Msemo, S
15:20 – 15:35	Discussions (Questions and Answers)	Discussions (Questions and Answers)	Discussions (Questions and Answers)
END OF SESSIONS 19, 20 & 21			
15:35 – 15:50	Wrap up Day One and Logistics if any		Mr. Abdallah Henku/ Dr. Chelestino Balama
15:50 – 16:00			TEA/COFFEE
16:00 – 17:00	Side event Title: The role of urban green spaces on biodiversity conservation		Tanzania Wildlife Research Institute (TAWIRI)
END OF DAY TWO			
DAY THREE 13TH DECEMBER 2024			
07:30 – 08:30	Registration		Secretariat
08:30 – 09:05 SESSION 22: KEYNOTE ADDRESS 6 VENUE: Simba Hall SESSION REPPORTEURS: Mr. James Lyamuya and Ms. Nezia Byakugila			
08:30 – 08:35	Announcements and Reflection on Day two across all sessions		



		Mr. Abdallah Henku/ Dr. Chelestino Balama	
08:35 – 09:00	Theme 6: Green and blue economy policy and governance Keynote Address: Contribution of forest policy frameworks in achieving green and blue economy national targets: Experience from Tanzania	Dr. Siima S. Bakengesa	
09:00 – 09:10	Discussions (Questions and Answers)	Mr. Abdallah Henku	
END OF SESSION 22			
09:10 – 09:15	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS		
09:15 – 10:20 PARALLEL SESSIONS 23, 24 & 25			
TRACK THEME	Theme 7: Clean energy solutions for sustaining forest landscapes	Theme 2: Forest degradation, biodiversity conservation and nature based solutions	Theme 8: Forest landscape restoration governance and management
SESSIONS	Venue: Room K 222 Session 23 Chair: Dr. Zacharia J. Lupala Rapporteurs: Dr. Numan S. Amanzi and Ms. Milkajane J. Sangiwa	Venue: Simba Hall Session 24 Chair: Dr. Elisha E. Njoghomi Rapporteurs: Mr. James Lyamuya and Ms. Nezia Byakugila	Venue: Room K 204 Session 25 Chair: Dr. Lawrence Mbwambo Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge
09:15 – 09:30	Towards formalizing wood charcoal businesses in Tanzania: An	Effect of human activities on woody species diversity, composition,	Opportunities and challenges in disseminating forestry and



	exploratory investigation Mramba, N.R	structure and carbon storage in a dry miombo woodland site, Tanzania Mwakalukwa, E.E	beekeeping research results: Case of academic and research institutions in Tanzania Njovangwa, G
09:30 – 09:45	Assessing sustainability impacts of increased harvest for firewood and charcoal production in mainland Tanzania Latta, G	Developing seed collection calendar for the establishment and conservation of indigenous tree species in Tanzania Pima, N.E	Six year growth performance of Eucalyptus hybrid clones in Rondo, Tanzania Nyarobi, H.A
09:45 – 10:00	Analysis of related policies and legal framework hindering sustainable charcoal value chain promotion in Tanzania Kessy, J.F	Influence of Land Use and Land Cover Alterations on Behavioral Patterns of Zanzibar Red Colobus Monkeys (<i>Piliocolobus Kirkii</i>) In Jozani-Chwaka Bay National Park in Tanzania Mayengo, G	Forest governance research in Tanzania: Analysing social and epistemic patterns in scientific publications Sunagawa, S Online Presentation
10:00 – 10:20	Discussions (Questions and Answers)	Discussions (Questions and Answers)	Discussions (Questions and Answers)
END OF SESSIONS 23, 24 & 25			
10:20 – 10:30	POSTER PRESENTATIONS & EXHIBITIONS		
10:30 – 10:50			TEA/COFFEE



10:50 – 11:35 SESSION 26: KEYNOTE ADDRESS 7 & 8 VENUE: Simba Hall SESSION REPPORTEURS: Mr. James Lyamuya and Ms. Nezia Byakugila		
10:50 – 11:15	Theme 7: Clean energy solutions for sustaining forest landscapes Keynote Address: Clean Energy Solutions for Sustaining Forest Ecosystems in Tanzania	Ms. Gisela Ngoo
11:15 – 11:40	Theme 8: Forest landscape restoration governance and management Keynote Address: Forest landscape restoration governance and management: What is the implication on implementation of FLR Programmes?	Prof. Paxie Chirwa
11:40 – 12:00	Discussions (Questions and Answers)	Mr. Abdallah Henku
END OF SESSION 26		
12:00 – 12:05	BREAK TO RESPECTIVE VENUES FOR PARALLEL SESSIONS	
12:05 – 13:10 SESSION 27		
TRACK THEME	Theme 8: Forest landscape restoration governance and management	
SESSION	Venue: Simba Hall Session 27 Chair: Dr. Siima S. Bakengesa Rapporteurs: Mr. Joshua Maguzu and Mr. Adam Shemahonge	
12:05 – 12:20	Effectiveness of assisted natural regeneration approach in achieving landscape restoration: A case of Miombo woodland restoration in Tanganyika District, Tanzania	Lorri, P



12:20 – 12:35	Assessment of the effect of membership into the forest farmers' organisations on the livelihoods of smallholder forest farmers in Kilolo District, Tanzania	Mmary, Z.S
12:35 – 12:50	Mapping Mangrove forests of Tanzania	Mangora, M.M
12:50 – 13:05	Advancing Tree Improvement in East Africa: A look at Tanzania's Collaborative Trial program (TIRWG)	Kimani, C.K
13:05 – 13:20	Is <i>Gmelina arborea</i> a viable option for timber supply in coastal areas of Tanzania?	Sangiwa, M.J
13:20 – 13:35	Forest Landscape Restoration in Tanzania: WWF Tanzania ground experience	Sawe, T
13:35 – 14:05	Discussions (Questions and Answers)	
END OF SESSION 27		
<div style="display: flex; justify-content: space-between; align-items: center;"> 13:50 – 14:35  LUNCH BREAK </div>		
SESSION 28: CLOSING CEREMONY Facilitator: Mr. Abdallah Henku		
14:35 – 14:45	Guest of Honor to arrive at the Exhibition grounds	Protocol
14:45 – 14:55	Guest of Honor to be briefed on the Conference in the VIP Room	Dr. Revocatus Mushumbusi TAFORI DG
14:55 – 15:00	Guest of Honor to enter the conference room	Mr. Abdallah Henku
15:00 – 15:20	Presentation on Emerging Issues and recommendations	Dr. John Mbwambo 3 rd ISC Committee Chairman



15:20 – 15:30	Guest of honor awarding certificates to keynote speakers	Hon. Ambassador. Dr. Pindi Chana (MP) Minister of Natural Resource and Tourism (MNRT)
15:30 – 15:35	A word of thanks from the TAFORI Board chair and presenting a request to the Guest of Honor to Officiate the Conference Closing	Prof. Verdiana Grace Masanja, Chairperson of TAFORI Board of Directors
15:35 – 15:40	Official Closing Address	Hon. Ambassador. Dr. Pindi Chana (MP) Minister of Natural Resource and Tourism (MNRT)
15:40 – 15:50		 TEA/COFFEE
END OF SESSION 28		
END OF DAY THREE		

KIPINDI NAMBA 28: SHEREHE YA KUFUNGA KONGAMANO
Mwezeshaji: Bw. Abdallah Henku

08:35 – 08:45	Mgeni Rasmi Kuwasili katika viwanja vya AICC	Itifaki
08:45 – 08:55	Mgeni rasmi kupewa taarifa fupi kuhusu kongamano	Dkt. Revocatus Mushumbusi, Mkurugenzi Mkuu - TAFORI



08:55 – 09:00	Mgeni rasmi kuingia ukumbini	Bw. Abdallah Heenku
09:00 – 09:20	Mawasilisho kuhusu masuala yaliyojitokeza na mapendekezo	Dkt. John Mbwambo, Mwenyekiti wa Kamati ya Maandalizi ya Kongamano
09:20 – 09:30	Mgeni Rasmi kutoa Vyeti kwa waliotoa mada kuu	Mhe. Balozi, Dkt. Pindi Hazara Chana (Mb) – Waziri wa Maliasili na Utalii
09:30 – 09:35	Neno la shukurani kutoka kwa mwenyekiti wa Bodi ya Wakurugenzi - TAFORI na kuwasilisha ombi kwa Mgeni Rasmi Kufunga Kongamano	Prof. Verdiana Grace Masanja, Mwenyekiti wa Bodi ya Wakurugenzi - TAFORI
09:35 – 09:40	Kufunga Kongamano	Mhe. Balozi, Dkt. Pindi Hazara Chana (Mb) – Waziri wa Maliasili na Utalii

09:40 – 09:50



TEA/COFFEE

MWISHO WA KIPINDI NAMBA 28

MWISHO WA SIKU YA TATU

KARIBUNI TENA | #KAZI IENDELEE



2.0 ABSTRACTS

2.1 Oral Presentation - Abstracts

2.1.1 Financing forest and beekeeping

This sub-theme has one keynote speaker and one paper presenter which in total sum up to two presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Mbwambo, L.	2
Paper presenters	Mbwambo, J.R.	3



2.1.1.1 Status of forest and beekeeping financing in Tanzania

*¹Mbwambo, L., ²Amanzi, N., ²Balama, C and ²Mushumbusi, R.P.

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²Tanzania Forestry Research Institute, P.O. Box 1854, Morogoro

*Corresponding author: lmbwambo@wwftz.org

Abstract

Tanzania has 48.1 million hectares of forest, covering 55% of its land area. These forests provide goods and ecosystem services that support livelihoods and contributing to sustainable development goals (SDGs). However, deforestation, driven by unsustainable practices such as shifting cultivation and charcoal production, is a critical challenge, with an annual loss of 469,420 hectares. All these happens because of limited financial capacity to manage forest and beekeeping resources all over the country, in particular resources linked to solution based research. Research and development is among the solution that provide effective and efficient technologies for sustainable forest management. Key financial requirements for forest and beekeeping management include combating illegal activities, boundary consolidation, reforestation, and capacity building. There are two existing financing mechanisms that are currently in place for the forest and beekeeping sectors in Tanzania. These include 1) Government supported and 2) Development partners supported. Government-Supported financing mechanisms involves allocating funds through ministries such as the Ministry of Natural Resources and Tourism (MNRT). Development partners' financing initiatives include funds allocated by different conservation Non-government entities in forest management. Despite the existence of these mechanisms, there is still a significant funding shortfall in the management of forests and beekeeping activities in the country. To address the challenge, there is a need to leverage existing funding opportunities to increase revenue, hence enhanced funding for the forestry and beekeeping sectors. These opportunities include allocating funds from carbon credits, public-private partnerships, and community-based management initiatives.

Keywords: *Forestry, beekeeping, financing mechanisms, carbon credits, public-private partnerships*



2.1.1.2 Financing reforestation and beekeeping projects to accelerate landscape and ecosystem restoration

*Mbwambo, J.R., Msuya, T.S., Magafu, L.E. and Ally, J.Y.

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Abstract

Governments in developing countries, including Tanzania, are seeking sustainable funding for natural resources conservation due to reduced financial support from external partners. The Tanzania Forest Fund (TaFF) was established under the Ministry of Natural Resources and Tourism (MNRT) to provide a reliable funding mechanism for protecting, conserving, managing, and developing the country's forest resources. Since its establishment in July 2011 TaFF has granted about 52 Billion Tanzania shillings to over one thousand projects, significantly contributing to forest conservation. It has facilitated tree planting and restoration of more than 19,000 hectares of forest and supported over 320 beekeeping projects, which have helped reduce pressure on natural forests and improve livelihoods through sales of bee and wood products. This review paper offers a detailed analysis of the levels of engagement among various beneficiary groups and evaluates successes in forest landscape restoration over the past five years. Information was gathered from progress and project monitoring reports to provide quantitative insights into TaFF's contributions to landscape restoration. Results show that, over the past five years more than 60% of the projects receiving grants were community-led initiatives focused on tree planting or forest restoration through beekeeping. Grants awarded to institutions and non-governmental organisations, which account for about 20% of the total, primarily aimed to generate information on forest conservation but were not directly linked to landscape restoration. Additionally, around 10% of grants were allocated to schools for establishing tree nurseries, where young people were trained in nurturing various tree species and techniques for restoring their local landscapes. In the past five years about 8,000 ha were planted and 3000 ha restored contributing to improving forest landscapes in Tanzania. It was concluded that, TaFF grants have contributed to forest restoration and fostered community awareness and engagement in landscape restoration efforts across the country.

Keywords: *Community, funding, projects, restoration, schools*



2.1.2 Forest degradation, biodiversity conservation and nature based solutions

This sub-theme has one keynote speaker and eighteen paper presenters which in total sum up to nineteen presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Schaffner, U.	2
Paper presenters	Mwangeka, N.	4
	Lasway, J.V.	4
	Meela, F.	4
	Nyahe, S.	8
	van Haeff, R.	8
	Maguzu, J.	12 & 16
	Kindeketa, W.K.	12
	Laswai, F.	12
	Nadir, S.	16
	Kilimba, A.	16
	Mtuy, E.T.	16
	Amanzi, N.S.	16
	Maduka, M.S.	20
	Xavery, D.	20
	Pima, N.E.	24
	Bungwa, Z.S.	24
	Mayengo, G.	24
	Mwakalukwa, E.E.	24



2.1.2.1 *The trouble with invasive non-native trees in East Africa*

*Schaffner, U.

Ecosystems Management, CAB International

*Corresponding author: u.schaffner@cabi.org

Abstract

Many non-native trees and shrubs were deliberately introduced into Africa as a source of wood or fodder, or to 'regreen' degraded land. Yet, several of these introduced species have become invasive and now cause serious impacts on nature and people. Invasive species are one of the key drivers of land degradation and biodiversity loss, but they tend to receive less attention than other drivers. Addressing drivers of land degradation and biodiversity loss represents a major global challenge that is critical for meeting key targets of sustainable development, including hunger and poverty alleviation, climate change mitigation and the promotion of peaceful and inclusive societies. I provide examples of invasive trees impacting nature and livelihoods in East Africa and explore ways to integrate invasive species management into natural resource management and land use planning to prevent further degradation and to increase the resilience of communities to climate change. *Prosopis juliflora* (also called Mathenge or Mrashia), arguably the most problematic invasive tree in East Africa, is a threat to multifunctional landscapes as it can invade grasslands, wetlands, cropland, settlements and protected areas. Using the example of *P. juliflora*, I elaborate how a participatory approach can lead to the development of spatially explicit management strategies which can curb the invasion process at the landscape level. Such an approach includes measures to prevent the introduction of invasive trees into uninvaded areas, as well as early detection of new invasions and rapid response. Lessons learned from other parts of the world show that managing widely distributed invasive trees and shrubs is much more challenging and often requires biological control as part of an integrated management approach. As invasive species will continue to spread if left uncontrolled, I advocate for a rapid implementation of the National Invasive Species Strategy and Action Plan in Tanzania.

Keywords: *Invasive species, non-native trees, Prosopis juliflora*



2.1.2.2 Assessment of nature based solutions in Kilifi mangrove ecosystems in Kenya

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Abstract

Nature Based Solutions (NbS) plays a critical role in driving sustainable economic development and addressing global challenges such as climate change, food insecurity and biodiversity loss. Over 40% of mangroves in Kilifi County are degraded because of anthropogenic activities and climate change. The present study conducted a feasibility assessment to determine existing and potential nature-based solutions in mangrove adjacent areas of Mtwapa, Takaungu, and Kilifi creeks. The study employed both qualitative and primary data collection approaches from targeted audience. Primary data collection focused on mapping of targeted key stakeholders while participatory qualitative data utilized key informant interviews and focus group discussions. From the study, the existing and well-established nature-based solutions within Mtwapa, Kilifi and Takungu creeks mangrove ecosystem were beekeeping, fishing, seaweed farming and mangrove nursery establishment, which had a huge potential to be successful nature based enterprises. The community around Mtwapa creek, prioritised ecotourism, mariculture and clean energy as potential nature based solutions. For Kilifi-Takaungu creeks; seaweed farming was identified and prioritised. In conclusion; eco-tourism, mariculture, seaweed farming, agroforestry and clean energy were identified and prioritised as potential nature based solutions. However, the cost and benefit analysis of the identified potential nature based solutions should be undertaken for sustainability.

Keywords: *Enterprises, mangroves, nature, potential, solutions*



2.1.2.3 Impacts and severity of pests and diseases affecting conservation of mangrove forests in Kenya

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Abstract

Globally, both biotic and abiotic factors threaten the health of mangroves reducing forest cover hence need for this study. A pest and disease survey was carried out in Lamu and Kilifi mangrove ecosystems to identify pests and diseases affecting mangroves. The study focused on identification, species specificity, occurrences and severity of infestation and infection. The surveyed areas were dominated by *S. alba*, *C. tagal*, *R. mucronata*, *A. marina*, *B. gymnorrhiza*, *L. racemosa*, and *X. moluccensis* in mixed or pure stands. From the survey, the following pests were identified; Manglicolous lichen, Mistletoe, barnacles, *Salagena obsolescens*, *Bottegia rubra*, *Littoraria* sp. Bagworm, *Oecophylla longinoda*. The incidences and severity were significantly influenced by mangrove species. *S. alba* had the highest severity of 61.8%, *A. marina* (46.2%), *R. mucronata* (44.1) *B. gymnorrhiza* (42.7%), *C. tagal* (42.6%), and *X. granatum* (42.4%). *S. alba* was heavily infested by two wood boring insects; *Salagena obsolescens* (larvae moth) and *Bottegia rubra* resulting in die back. *R. mucronata* is highly infested by barnacles compared to other species while *B. gymnorrhiza* is not affected. *R. mucronata* is infested by *Littoraria* sp with a high incidence in Kilifi County resulting in leaf spots and necrosis. In conclusion, most pests and diseases were reported in *R. mucronata*, *A. marina* and *S. alba*. Special attention on conservation of *Sonneratia alba* as it is severely affected pests.

Keywords: Diseases, Kenya, management, mangroves, pests



2.1.2.4 Status of Mangrove degradation in mida creek ecosystem, Kenya

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Abstract

Globally, mangrove ecosystems are distributed along tropical and subtropical coastlines. Kenya's mangroves are particularly under increasing threat from both natural and anthropogenic factors. In Mida Creek, illegal logging as well as land encroachment are the major human activities threatening the mangrove ecosystem. The objective of the study was to assess and map the status of mangrove degradation to guide rehabilitation and conservation activities within the creek. The study employed local community participatory approach in physical identification and GIS mapping of the degraded sites. To establish extents or areas of possible degradation, a remote sensing approach targeting vegetation change assessment over a five (5) and two (2) year temporal span was undertaken. During physical ground verification, at least 30 geo-points were sampled for ground truthing based on the satellite assessment of mangrove vegetation. The study employed GPS devices and mobile phone based online survey data tools for physical ground mapping. From the findings, approximately 337ha of mangroves were degraded. The status of mangrove degradation in Mida Creek was generally moderate to low with major threat being illegal harvesting. Bait harvesting for fishing was an emerging threat to mangroves. For restoration activities in Mida Creek, about 276ha of degraded area was identified for restoration with the following being recommended; assisted or planting (12.3ha), enrichment planting (48.6ha) and natural regeneration (215.6 ha). The most common mangroves species identified in the degraded areas were; *Rhizophora mucronata*, *Avicennia marina*, *Sonneratia alba*, *Ceriops tagal* and *Bruguiera gymnorhiza*. Most restoration plantings observed were for *Rhizophora mucronata* and *Ceriops tagal*. In conclusion, alternative livelihood support programmes were required to reduce pressure on illegal harvesting; regulated bait harvesting and adoption of community-based mangrove ecosystem restoration was recommended.

Key words: Degradation, mangroves, mida creek, status



2.1.2.5 Woody vegetation structure, floristic composition and species richness along the elevation gradient of Mt. Meru, Tanzania

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Abstract

Understanding how vegetation composition changes along elevational gradients is crucial for species conservation in a changing world. In this study, we focused on protected habitats along the eastern slope of Mount Meru to examine how species richness, tree height, and floristic composition of woody plants change with elevation. Additionally, we analyzed the combined influence of temperature and precipitation on these vegetation variables. Data on vegetation were collected from 44 systematically placed plots across five transects, covering an elevation gradient ranging from 1600 to 3400 meters above sea level (m a.s.l). Using ordinary linear models and multivariate analyses, we investigated the effects of mean annual temperature and precipitation on woody plant species richness, tree height, and floristic composition. Our findings revealed that as elevation increased, species richness, mean tree height, and maximum tree height showed a steady decline. Models considering only mean annual temperature as an explanatory variable performed best in predicting changes in species richness and tree height along the elevation gradient. Furthermore, significant alterations in woody plant floristic composition occurred with changing elevation, driven by the interaction between mean annual temperature and precipitation. While temperature consistently influenced plant communities along the elevation gradient, precipitation played a more critical role for plant communities at lower elevations compared to those at higher elevations. Based on our study, we propose that ongoing climate change-



induced shifts in temperature and precipitation patterns will reshape elevational gradients of diversity, tree height, and carbon storage correlations in ecosystems. Consequently, the sequence of tree communities on East African Mountains is likely to undergo transformation.

Keywords: *Arusha National Park, floristic diversity, mean annual precipitation, mean annual temperature, woody plant community*

2.1.2.6 Demonstrating nature-based solutions in the Mindu Dam Catchment area: The case for agroforestry in Morogoro

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The Mindu Dam constitutes over 75% of the drinking water provision by MORUWASA in Morogoro Municipality. The catchment area of the Mindu Dam spans 303 square kilometers and receives water from five main rivers. The capacity of this dam has significantly decreased due to siltation as a result of deforestation, unregulated agriculture, rapid population growth, climate change, and subsequent riverbank erosion. This situation affects both the quantity and quality. Nature-based solutions along one of the five rivers -Ngerengere River- are now piloted and presented by a joint effort from MORUWASA, WAMI/RUVU, and World Waternet. The long-term objectives of the pilot are to ensure the security of water resources and water availability, while actively involving communities in managing water sources. The short-term (2 years) objective is to demonstrate the effectiveness of nature-based solutions in water resources management along Ngerengere River, before expanding to the whole catchment area. Agroforestry demonstration plots, including beekeeping, tree nurseries, and farmer training, are being established with a particular focus on the vulnerable 60-meter demarcated zone from the river. Agroforestry practices - including riparian, fruit, spice, and banana - were designed with the FarmTree Tool, which allows for documenting and monitoring the established demo sites. Additionally, cattle troughs, charco dams, and check dams are being constructed to increase rainwater storage, prevent riverbank erosion and runoff, and reduce the speed of water flow in the river. All interventions are monitored in a participatory monitoring framework,



including monitoring stations. In addition, communication and awareness to share experiences and inspire others is a key element of the pilot project. After two years, the project should be able to show tangible results and conclude the effectiveness of the interventions. The extensive documentation and monitoring should support commitment and funding to scale the interventions to the entire MDCA in Tanzania.

Keywords: *Agroforestry, apiculture, communities, IWRM, nature-based solutions*

2.1.2.7 Variation of soil properties under different site classes of *Pinus patula* stands at Sao hill and Shume forest plantations in Tanzania

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Abstract

A study was conducted to investigate soil properties and their variations under different site classes in *Pinus patula* stands at Sao Hill Forest Plantations (SHFP) and Shume Forest Plantations (SFP) in the South-western (SW) and North-eastern (NE) highlands of Tanzania. Soil samples were collected at two depths (0-20 and 20-40 cm) from four different site classes using standard techniques. The samples were then analyzed using standard procedures, and the results were subjected to Generalized Linear Model Analysis of Variance (ANOVA). The results revealed significant differences between site classes in sand content at SHFP, while differences in clay, silt, volumetric water content, and soil water-filled pore spaces were observed at SFP. Additionally, bulk density increased with soil depth at both sites, with the surface layer exhibiting higher volumetric water content and soil water-filled pore spaces. Soil pH values indicated very strong acidic for both SHFP and SFP, with significant variations in pH observed between subsurface and



surface layers at SHFP. Furthermore, differences in the concentration of calcium, magnesium, Cation Exchange Capacity (CEC), available phosphorus, and Soil Organic Carbon (SOC) were found between site classes at both SHFP and SFP. In contrast, the surface layer had higher Ca and Mg concentrations, while CEC was higher in SFP than in SHFP. The study concluded that the observed differences in soil properties under different soil depths were a result of the different site classes. It emphasized that future soil management strategies should focus on encouraging proper harvesting technologies and retention of harvest residues to mitigate the continuous loss of soil nutrients and improve forest productivity.

Keywords: *Forest productivity, physical and chemical properties, soil depth, site classes*

2.1.2.8 Unutilised tourism potentials in the remaining natural patches of Mufindi District, Tanzania

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Abstract

Mufindi District is one of the districts of the Iringa Region of Tanzania. It is partly in the Eastern Arc Mountains' southern limit, which contains a significant global centre of biological diversity and endemism. The Mufindi District has different land uses, including settlements, seasonal crops, natural patches and forests, woodlots, and tree and tea plantations. The remaining natural (forest) patches are under immediate threat due to various human activities and unknown tourist potentials, harbour species of conservation concern and uniqueness. Our study, which collected species occurrence records and information from various sources, including literature, the International Union for Conservation of Nature (IUCN), herbaria, and databases, has made a significant discovery. We found the area has high plant richness and many globally threatened and geographically restricted species in Tanzania, some of which can be used as flagship (unique) plant species for tourism attraction. Notable among these species are *Oxyanthus lepidus* subsp. *kigogoensis*, *Agelanthus atrocronatus*, *Aframomum laxiflorum*, *Monanthonotaxis*



discolour, *Impatiens keillii* subsp. *pubescens*, and *Habenaria richardsiae*. These findings are not just interesting but crucial for the region's future of tourism and conservation. By mapping, packaging, and marketing the unique plant species and landscapes in the remaining natural patches and forests, we can stimulate tourist activities in the Southern Highlands. This will provide a sustainable source of community livelihoods and contribute significantly to biodiversity conservation, underscoring the importance of our proposed tourism activities for the environment.

Keywords: *Mufindi, biodiversity, tourism, conservation, southern highlands, eastern arc mountains*

2.1.2.9 Productivity of *Pinus patula* (Schltdl & Cham) in first and second rotations at Sao Hill Forest plantation in Iringa, Tanzania

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Abstract

This study compared the growth of *Pinus patula* in its first (R1) and second (R2) rotations in the Sao Hill Forest Plantation (SHFP). Tree height and diameter at breast height (Dbh) were assessed in plots laid systematically from upper slope of compartment to the lower. Basal area, stand volume and mean annual increment (MAI) were calculated using different equations. The t- test results indicated significant difference ($p < 0.05$) in mean Dbh, height, basal area, stand volume and MAI for *P. patula* between R1 and R2. The mean Dbh was low 15.92 ± 0.16 in R1 compared to 16.25 ± 0.10 for R2 similarly to height 13.72 ± 0.11 and 15.89 ± 0.08 for R1 and R2 respectively. Basal area ($m^2 ha^{-1}$) was low 8.02 ± 0.09 in R1 compared to 8.15 ± 0.08 for R2. Furthermore, there was significant variation ($X^2 = 4.4011$, $df = 1$, $p = 0.036$) in stand volume and MAI respectively between R1 and



R2. The mean stand volume was lower ($67.50 \pm 1.22 \text{ m}^3 \text{ ha}^{-1}$) in R1 than $70.89 \pm 0.97 \text{ m}^3 \text{ ha}^{-1}$ in R2 and also MAI was low 6.95 ± 0.12 in R1 than $7.09 \pm 0.10 \text{ m}^3 \text{ ha}^{-1} \text{ yr}^{-1}$ for R2. Nutrient analysis revealed relative changes (positive/negative) in macro and micronutrient concentrations between the rotations, likely due to variations in soil properties. Essential macro nutrients N, P, K Ca, Mg and S concentrations differed significantly $p < 0.05$ between R1 and R2. The Micro elements Cu, Fe and Mn were in high concentration in R2 while Al^{3+} , Ca and Na were higher in R1. Soil organic carbon was higher in R2. The study recommends proper site selection, land preparation, seed quality, and management practices to optimize *Pinus patula* growth in future rotations

Keywords: *Productivity, mean annual increment, stands volume, basal area, soil properties*

2.1.2.10 Status of invasive *Prosopis juliflora* and its ecological impacts on native forbs and grasses in Northern Tanzania

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Abstract

Prosopis juliflora, commonly known as Mesquite, is an invasive species that poses significant ecological and socio-economic challenges in arid and semi-arid regions worldwide. Its aggressive spread in Tanzania threatens native biodiversity, agricultural productivity, and local livelihoods. Understanding its population density, distribution, and impact is crucial for developing effective management strategies. This study aimed to assess the population density, distribution, and ecological impact of *P. juliflora* in Northern Tanzania. Data were collected through line transects and quadrants to record the presence and density of *P. juliflora* across wards and land use types. Descriptive statistics were employed to summarize abundance, density, and basal area of *Prosopis juliflora* across wards and land use categories. Wilcoxon test was used to determine whether forb and grass richness, Shannon diversity index, abundance, and cover varied between



not invaded sites and invaded sites. Negative Binomial Regression was employed to examine the influence of environmental variables on population density of *P. juliflora*. The study revealed significant variability in *P. juliflora* population densities across wards and land use types, with settlement areas and grazing lands showing the highest densities. The population structure analysis indicated that most *P. juliflora* trees are in smaller diameter classes, suggesting young populations with a high potential for further spread. The presence of *P. juliflora* was associated with a significant reduction in forb and grass richness, Shannon diversity index, abundance, and cover. Spatial distribution mapping highlighted high-density areas, particularly in southern wards, while environmental factors such as temperature, soil properties, and proximity to roads were identified as significant predictors of *P. juliflora* density. The findings underscore the need for targeted management strategies to control the spread of *P. juliflora* in Tanzania. The species' adaptability to various environmental conditions and its impact on native ecosystems necessitate ongoing monitoring and intervention to mitigate its adverse effects.

Keywords: *Invasive, Prosopis juliflora, Northern Tanzania*

2.1.2.11 Bee diversity and distribution in a protected area at Mulele hills forest reserve in Katavi Region, Tanzania

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Abstract

Bees are vital pollinators, facing global decline and threatening forest and agricultural ecosystems. While their importance is recognised, knowledge about bee diversity in protected areas of Tanzania remains limited. This study assessed bee diversity and distribution in Mulele Hills Forest Reserve in Katavi region of Tanzania. Specifically, the study determined abundance, diversity and spatial



distribution in three different habitats namely closed woodland, open woodland and grassland, for the purpose of establishing conservation efforts to protect them in that forest reserve. A systematic sampling design was employed, where 150 pan traps of different colors were maintained for 14 days along four transects to collect bees. Coordinates for each plot were marked using the Garmin Global Positioning System (GPS). In addition, Hand nets were used to collect specimens during the periods of high insect activity (between 06:30-09:00 and 15:00-18:30 hours) while walking transects within the plots. Species diversity was computed using Shannon diversity Index, while abundances were calculated by counting the number of individuals per habitat. Bee occurrences were mapped using QGIS. A total of 304 bees representing 39 species in the families Apidae, Megachilidae, Halictidae and Colletidae were collected. The highest bee abundance occurred in the closed woodland, dominated by the family Apidae (238 out of 304). The highest bee diversity occurred in the grassland ($H' = 2.22$) followed by closed woodland ($H' = 2.08$) and lastly grassland ($H' = 1.9$). This study contributes to the understanding of bee communities in Mulele Forest Reserve, highlighting their importance as refuges for diverse bee assemblages. These findings will inform and guide targeted conservation efforts within Mulele Hills Forest Reserve and across Tanzania.

Keywords: *Bee abundance, bee diversity, habitat, pan traps, transect walking*

2.1.2.12 Do forests and woodlands on village land forest reserves in Tanzania vanish? Empirical evidence from Ruvuma Transboundary Landscape

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Abstract

The paper presents the status of deforestation in Village Land Forest Reserves (VLFRs) across the Ruvuma Transboundary Landscape to inform sustainable forest management practices. The study focuses on determining forest cover change and the social aspects driving modifications across eight VLFRs in Kilwa, Liwale, Mtama, Ruangwa, Rufiji, Tunduru, Songea, and Namtumbo districts.



Geographical Information System (GIS) and Remote Sensing (RS) techniques were used to analyze forest cover changes between 2017 and 2022. Thereafter, group discussion was conducted to determine the social aspects driving the forest cover change in the respective villages. The findings revealed varying degrees of forest cover change ranging from 1 to 4%, driven by a combination of direct and indirect factors. Direct factors were the major factors influencing forest cover change in the VLFRs. These factors included illegal farming of food and cash crops, fuelwood production mainly charcoal, grazing, and forest fires, which are linked with unsustainable livelihood activities of forest adjacent communities. Indirect or external factors such as market forces, institutional dynamics, demography, and technology, also played significant roles in driving forest cover change in the VLFRs. In light of these findings, the study emphasizes the need to address both direct and indirect factors to enhance the management of VLFRs. It is recommended to promote sustainable livelihood options and strengthening the capacity of local institutions to effectively manage and mitigate these factors.

Keywords: *Deforestation, Lindi, Pwani, Ruvuma, Southern Tanzania*

2.1.2.13 Population status and economic potential of high-valued indigenous timber species in Tanzania: A case study of *Pterocarpus tinctorius*, *Osyris lanceolata*, and *Bobgunnia madagascariensis*

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Abstract

Over-exploitation of forest resources is a significant global threat to biodiversity, leading to population declines and extinction of species. This degradation not only disrupts ecosystems but also diminishes the economic benefits derived from valuable species. This study investigates the potential demand and external trade



of high-value indigenous timber species in Tanzania, focusing on *Pterocarpus tinctorius*, *Osyris lanceolata*, and *Swartzia/Bobgunnia madagascariensis*. It evaluates their population status and economic contributions in natural forests on mainland Tanzania. Biophysical analyses were conducted in sampled plots to assess stem density, basal area, and stand volume. The findings show that *O. lanceolata* had the highest stem density at 33 stems/ha, followed by *P. tinctorius* (25 stems/ha) and *S. madagascariensis* (17 stems/ha). For the basal area, *S. madagascariensis* ranked highest with 2.03 m²/ha, compared to *P. tinctorius* (0.55 m²/ha) and *O. lanceolata* (0.013 m²/ha). Similarly, in terms of stand volume, *S. madagascariensis* dominated with 26.96 m³/ha, followed by *P. tinctorius* (5.12 m³/ha) and *O. lanceolata* (0.030 m³/ha). Economically, *P. tinctorius* accounted for 7.4% of the total demand (13,944.6 m³ out of 188,440 m³), with an annual value of TZS 65.9 billion. Conversely, *S. madagascariensis* contributed only 0.19% of the demand. Given their ecological and economic importance, a robust conservation strategy is required. Such a strategy would aim to restore the populations of these species, promote their sustainable use in forest industries, contribute to landscape restoration, and enhance resilience to climate change.

Keywords: *Over-exploitation, population decline, economic benefits, conservation strategy, landscape restoration*

2.1.2.14 Integrated landscape management to address woody invasion around Lake Natron in Tanzania

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Abstract



Invasive alien plant species significantly impact social-ecological systems such as animal and human health, which can change the economy and threaten livelihoods, presenting complex challenges and opportunities for management. Though invasive species were introduced to provide essential benefits such as firewood, shade, and food, their profound and often detrimental impacts on ecosystems can far outweigh these advantages, leading to significant ecological disruption and threatening the very livelihoods they were meant to support. We present an Integrated Landscape Management (ILM) program, aimed at addressing the dual nature of invasive species, such as *Prosopis juliflora*, which provide benefits like firewood and shade while simultaneously threatening biodiversity and livelihoods. The ILM program emphasizes stakeholder engagement by establishment of a Local Implementation Group (LIG) in Tanzania's Lake Natron basin. The groups facilitated collaborative decision-making, enabling stakeholders to develop spatial management plans that balance ecological integrity with community needs. The case study of *P. juliflora* illustrates how coordinated, community-led actions can mitigate the spread of invasive species, thereby conserving local biodiversity and supporting livelihoods. By fostering awareness and motivation among stakeholders, the ILM program created a plan for sustainable management of prosopis in the Lake Natron basin, ensuring that the benefits derived from these plants do not come at the expense of ecological health or community well-being, which has been adopted by District and Regional governments. This integrated approach is essential for developing effective strategies, co-developed and owned by many stakeholders, that address the multifaceted impacts of invasive species on social-ecological systems, ultimately contributing to the resilience and sustainability of the landscapes affected.

Keywords: *Invasive species, Prosopis juliflora, lake natron basin, local implementation group*

2.1.2.15 Developing seed collection calendar for the establishment and conservation of indigenous tree species in Tanzania

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Abstract

Understanding the phenological characteristics of indigenous tree species is essential for effective seed collection and mass seedlings' production. This study investigated the phenology of key species in Tanzania: *Azelia quanzensis*, *Khaya anthotheca*, *Prunus africana*, *Pterocarpus tinctorius*, *Entandophragma bussei*, *Pterocarpus angolensis*, *Melicia excelsa* and *Swartzia madagascariensis* to develop a seed collection calendar. The observations were conducted across various regions from June 2023 to July 2024 to document flowering, fruiting and seed collection seasons. The findings reveal that most species exhibit flowering and fruiting periods lasting between 3 and 6 months. Specifically, the flowering, which is triggered by the end of the winter period, starts from September to December, and the onset of the rainy period starts from March to May, while fruiting occurs from February to June, with variations depending on the ecological zone. Viable seeds are best collected during the dry season (July to October) when seeds are fully matured and exhibit higher germination rates after being pre-treated. On the other hand, *Melicia excelsa* has a short flowering and fruiting period, with seed collection occurring from December to January. The study identified variability in the timing of seed collection for the same species across different ecological zones, offering valuable insights for seed collectors and forest managers. Based on these findings, the developed seed collection calendar will serve as a vital tool for enhancing the establishment and conservation of these indigenous tree species at the right time supporting biodiversity and ecosystem stability in Tanzania. The study advocates for further research into the seed collection calendars of other threatened and endangered valuable tree species to optimize propagation and conservation efforts.

Keywords: *Phenology, indigenous tree species, flowering, fruiting and seed collection calendar*



2.1.2.16 Carbon for conservation: Harnessing REDD+ to address forest loss, degradation and biodiversity conservation in Tanzania

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Abstract

Deforestation and land use change significantly contribute to global greenhouse gas (GHG) emissions, adversely impacting biodiversity and ecosystem services fundamental to human well-being. In Tanzania, over 70% of GHG emissions derive from deforestation and land use change as more than 400,000 ha of forest are lost annually. Preventing deforestation and the impacts of forest degradation yields the potential to mitigate 25% of global emissions, concurrently safeguarding biodiversity and ensuring the continued provisioning of important ecosystem services. As such, we present an integrated approach to address anthropogenic causes of climate change and associated biodiversity loss, while supporting the sustainable development of forest-dependent livelihoods. Carbon financing, as a nature-based solution, effectively decelerates rates of forest loss and degradation, whilst contributing to biodiversity conservation by means of area-based approaches. In western Tanzania, REDD+ methodologies illustrate forest conservation benefits in terms of avoided carbon emissions, preservation of critical chimpanzee habitat and landscape connectivity, as well as other non-carbon benefits targeted at livelihoods development. Furthermore, in the Yaeda valley of northern Tanzania, it has been shown that REDD+ initiatives can potentially support intact assemblages of indigenous wildlife species, highlighting the need for a more formal integration of biodiversity conservation goals in the REDD+ scheme.

Keywords: *Carbon, emissions, REDD+, Yaeda*



2.1.2.17 Identification of key soil quality indicators for predicting mean annual increment in *Pinus patula* forest plantations in Tanzania

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Abstract

This study aimed to identify soil quality indicators and their impact on the Mean annual increment (MAI) of *Pinus patula* at Sao Hill (SHFP) and Shume Forest Plantations (SFP) in Tanzania. The forests were stratified into four site classes based on management records. Tree growth data were collected from 3 quadrat plots at each site resulting into 12 plots in each plantation, while soil samples were taken from 0-40cm soil depth. Analysis of variance examined the variation in soil quality indicators between site classes at two *P. patula* plantations sites. Covariance analysis assessed differences in MAI and stand variables across various site classes, taking into account the differing ages of some stands, with stand age serving as a covariate. Linear regression models explored the relationship between soil quality indicators and MAI, while partial least squares regression predicted MAI using soil quality indicators. The results showed that at SHFP, sand, OC, cation exchange capacity, Calcium (Ca), Magnesium (Mg), and available Phosphorus varied significantly between site classes while silt, clay and available P varied significantly at SFP. At SHFP, sand and clay content were positively correlated with MAI, while at SFP, silt content, available P, Potassium (K), Ca, and Mg showed significant positive correlations. Soil quality indicators including physical and chemical properties (porosity, clay percentages, sand content, and OC) and only chemical (K, Mg, Avail P, and soil pH) properties were better predictors of forest mean annual increment at SHFP and SFP respectively. The study underscores the importance monitoring the quality of soils in enhancing MAI and developing soil management strategies for long-term sustainability in forests production.

Keywords: *Soil quality indicators, mean annual increment, forest productivity, site classes, partial least square regression, variable important projection*



2.1.2.18 Influence of land use and land cover alterations on behavioral patterns of Zanzibar Red Colobus Monkeys (*Piliocolobus Kirkii*) In Jozani-Chwaka Bay National Park in Tanzania

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Abstract

This study examined the impact of land use and land cover (LULC) changes on the activities of colobus monkeys in the Jozani Forest, Zanzibar, from 1995 to 2024. The study was conducted in May 2024 using satellite imagery and ground-truthing techniques to analyze shifts in dense vegetation, sparse vegetation, bare land, agricultural land, and water bodies. Chi-square was performed to test the overall activity of *Piliocolobus kirkii* in different habitats the results indicated significant transformations driven by deforestation, reforestation, and agricultural expansion. Specifically, the area covered by dense vegetation increased from 17.7 km² in 1995 to 40 km² in 2024, reflecting successful reforestation initiatives. Whereas, bare land experienced substantial fluctuations, initially rising to 36.13 km² by 2003, decreasing to 4 km² in 2014, and slightly increasing to 12 km² by 2024. Agricultural land peaked at 14 km² in 2014 before declining to 7 km² by 2024. These dynamic LULC changes have affected colobus monkeys' habitat quality and availability, influencing their feeding, resting, and social behaviors. Additionally, the study revealed variations in colobus monkey behavioral patterns across different sex groups, with significant differences in feeding and social interactions associated with habitat changes. The findings emphasize the necessity for ongoing conservation efforts to mitigate the adverse effects of LULC changes on primate populations and maintain ecological balance in the Jozani Forest. To support the entire range of primate species and guarantee their long-term survival, it is also recommended that connectivity between sections of intact primary forests in human-modified landscapes be preserved.

Keywords: *Primates, connectivity, conservation, vegetation, habitat quality*



2.1.2.19 Effect of human activities on woody species diversity, composition, structure and carbon storage in a dry Miombo woodland site, Tanzania

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Abstract

The effects of human activities on forest condition of many forest reserves in Tanzania is well acknowledged but inadequately studied. Absence of this information creates challenge in planning for proper management and conservation of biodiversity and carbon stocks found in these reserves. This study assessed the effect of human activities on composition, diversity, structure and carbon stocks of Kitulughalo Forest Reserve which is under the management of Tanzania Forest Services Agency, located in Morogoro district, Tanzania. Data were collected from 30 concentric sample plots of 0.071 ha established systematically in the forest area of 2,038 ha. The information recorded includes diameter at breast height (dbh) of all trees and shrubs with ≥ 1 cm, counts of all trees and shrubs with < 1 cm dbh, human disturbances, elevation and slope. The results show that trees and shrubs with dbh ≥ 1 cm composed of 80 plant species and those with < 1 cm dbh composed of 34 plant species. Shannon-Wiener Diversity Index (H') for < 1 cm dbh was 3.35 and for ≥ 1 cm dbh was 3.73, indicating the forest to have high species diversity. Stem density for trees and shrubs with ≥ 1 cm dbh was $2\ 199 \pm 1\ 325$ stems ha^{-1} , basal area of 7.61 ± 4.47 m $^2ha^{-1}$, standing volume of 56.25 ± 35.03 m $^3ha^{-1}$, above ground carbon stocks of 18.97 ± 11.84 MgCha $^{-1}$ and below ground carbon stocks of 9.81 ± 5.71 MgCha $^{-1}$. The harvested stems composed of 21 species with estimated lost volume of 5.94 ± 4.47 m $^3ha^{-1}$ equivalent to the loss of above ground biomass of 4.60 ± 3.43 Mgha $^{-1}$ and carbon stocks of 2.30 ± 1.72 MgCha $^{-1}$. Grazing activities significant lowers the tree species diversity with p-value < 0.05 . Preparation of plans to promote management and conservation of biodiversity and carbon stocks found in the reserve is recommended.

Keywords: *Anthropogenic activities, biomass and carbon loss, catchment forests, disturbances, TFS-Kitulughalo Forest Reserve.*



2.1.3 Innovation and technologies in forest and beekeeping industries

This sub-theme has one keynote speaker and fifteen paper presenters which in total sum up to sixteen presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Masanja, V.	6
Paper presenters	Nyamaka, K.	5
	Mduda, C.	5
	Mweta, M.J.	5
	Wanjiku, J.	9
	Ngugi, S.K.	9
	Balama, C.	13
	Temba, G.P.	13
	Lukiko, S.	13
	Njonghomi, E.E.	17
	Gwegime, J.K.	17
	Mollel, N.P.	17
	Balama, C.	17
	Mwamakimbullah, R.	17
	John, E.	21
	Msemo, S.	21



2.1.3.1 Innovations in machine learning for forest restoration and climate change mitigation

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Abstract

Forests play a crucial role in maintaining biodiversity, regulating climate, and supporting sustainable development. In Tanzania, however, these landscapes are increasingly threatened by deforestation, land degradation, and climate change compounded by a significant lack of reliable, real-world data to inform effective management. Addressing these challenges requires leveraging advanced technologies like machine learning (ML) and artificial intelligence (AI) to develop innovative, data-driven solutions for forestry management and climate resilience. This keynote will explore how ML can enhance forestry management despite data limitations, highlighting approaches to optimize restoration planning, monitor forest health, and predict environmental changes. Specifically, we will discuss how ML algorithms, even when dealing with sparse or unreliable data, can support informed decision-making by utilizing surrogate data, pattern recognition, and predictive models. Applications such as supervised learning and clustering methods can still analyze variables related to soil quality, climate, and vegetation, aiding in strategic reforestation and climate resilience planning. Where complete data sets are unavailable, ML methods can employ transfer learning and data augmentation, providing essential insights and generating reliable approximations based on existing limited data. A key focus will be the integration of remote sensing technologies, such as satellite imagery and drone footage, with ML. These tools allow for real-time data collection, improving monitoring capabilities and offering a way to overcome some local data gaps by analyzing imagery for forest cover, carbon stock estimation, and areas at risk of degradation. By leveraging image recognition and analysis techniques, ML models can provide valuable insights into canopy density and forest health, enabling timely interventions in restoration efforts. This Keynote talk will also address optimization models, which help allocate



resources and prioritise reforestation areas, especially under constraints imposed by limited local data. By integrating spatial data with ML models, we can recommend tree species suited for specific environments and optimize the ecological and economic impact of restoration efforts. Recognizing the implementation challenges in resource-limited settings, I will discuss the infrastructure and capacity needed to utilize ML effectively in Tanzania's forestry sector. Collaborations that build local expertise and expand data collection methods are essential to sustainably overcome these limitations. The presentation will advocate for interdisciplinary approaches, stressing the importance of combining computational science with local field knowledge. With stronger data collection efforts, ML can become a transformative tool in Tanzania's forestry landscape, driving impactful, sustainable solutions for climate change mitigation and forest restoration.

Keywords: *Climate change, forest restoration, machine learning*

2.1.3.2 Temporal and spatial pattern of forest fires in the Tongwe west local authority forest reserve (2003-2023), Tanzania

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Abstract

Forest fires are among the most frequent natural disturbances worldwide, presenting serious risks to both society and the environment. Gaining insight into their spatial and temporal distribution is crucial for creating effective management strategies. This study analyzed the spatial and temporal patterns of forest fires in the Tongwe East Forest Reserve from 2003 to 2023, using moderate-resolution imaging spectroradiometer (MODIS) fire anomalies data. Temporal patterns were examined using descriptive statistics in IBM SPSS 26, while spatial patterns, including density and hot/cold spot zones, were analyzed using kernel density estimation and the Getis-Ord G_i^* hot spot tool in ArcGIS. A total of 9,239 forest fires were recorded in the Tongwe East during the 21-year period, burning an area



of 14,203.46 km². Forest fires typically started in May and persisted through October, with July being the peak burn month. Over the study period, there was a negative trend in wildfire occurrence, though variability was noted. The density of forest fires ranged from 0.3 to 1.6 fires per km² (16%) in areas of lowest density to 2.5–3.7 fires per km² (23%) in areas of highest density. Spatial analysis revealed high clustering of fires with a GIZscore of 1.1 to 12.7, and areas with low fire radiative power had GIZscores between -2.2 and 0.9. These low-radiative power areas, covering 2891 km² (17%), suggest that much of the Tongwe East is affected by forest fires that may not cause significant damage to the existing vegetation. The findings provide a scientific basis for zoning forest fire risk areas within the Tongwe East, allowing for targeted conservation efforts based on specific conservation goals.

Keywords: *Hot spot Getis-Ord Gi**, *kernel density*, *Tongwe east*, *spatio-temporal pattern*

2.1.3.3 The first record of honey bee parasitism by tachinid flies (*Tachinidae*) in Tanzania

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Abstract

Beekeeping productivity in Tanzania is significantly lower than its estimated potential. Factors such as inadequate management practices, the use of non-standardised equipment, environmental stresses, and the presence of pests and diseases may contribute to this shortfall; however, these issues have not been thoroughly investigated. This study reports the infestation and parasitism of honey



bee (*Apis mellifera*) colonies by tachinid flies. In an apiary located in West Kilimanjaro Forest Plantation, Siha district, two large, late instar larvae, likely from dipterous endoparasitoids, were discovered within the abdomens of live Tanzanian honey bees. The larvae had large, round, black posterior spiracles similar to those of *Rondaniooestrus apivorus* (Tachinidae), a previously reported bee endoparasitoid. The infested worker bees remained active but displayed signs of distress, including abdominal discoloration and bloating, reduced gut size, minimal food reserves, and indications of indigestion. Additionally, three pupae resembling tachinid flies were found at the hive entrances. Although the prevalence of these parasite larvae was low (3.3%), their presence may go unnoticed in live hosts, potentially allowing the parasite population to increase. Furthermore, tachinid flies could act as vectors for disease pathogens, posing a threat to the beekeeping industry. This is the first documented case of such parasitism in Tanzania, highlighting the need for further research to substantiate the threat posed by tachinid fly infestation.

Keywords: *Honey, bee parasitism, tachinid*

2.1.3.4 Evaluation of penetration, retention and distribution of chemical preservatives in various wooden pole classes in Mufindi District, Tanzania

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Abstract

This study was conducted in Mufindi District to determine the effectiveness of preservative treatment in ensuring the durability and longevity of wooden poles used in utility applications. Four distinct pole classes were selected based on their quality and origin. Samples were treated with a common chemical preservative. Penetration was measured using a graduated plate and retention was analyzed



using Energy Dispersive X-ray Fluorescence Spectrometer model number X-MET8000 Optimum (ED-XRF). Results showed that there were differences on how the preservative was absorbed, retained, and distributed among different classes of wooden poles. The higher-class poles had better absorption and more evenly distributed retention. The light poles had the highest retention levels, averaging 25.50 kg/m³, while medium poles demonstrated lower treatability. One-way ANOVA revealed significant differences in both penetration and retention among the pole classes, with stout poles showing significantly higher retention. A weak positive correlation ($r = 0.001$; $p < 0.05$) was observed between penetration and retention, indicating that factors other than penetration depth may influence retention effectiveness. The average penetration decreased with increasing pole size, ranging from 30.01 mm in light poles to 24.97 mm in stout poles, with an overall average penetration of 27.39 mm. Moisture content across all pole classes was similar, averaging 25.45%, although light poles exhibited slightly higher moisture content. Significant variations in CCA penetration and retention were observed along the length of the poles. The observed dynamics are crucial for optimizing preservation strategies to improve the durability and performance of wooden poles in various applications. Results suggest that preservative treatment protocols need to be customized as per pole size, with larger poles like stout poles receiving more intensive treatment to ensure adequate absorption. Further research on developing enhanced preservative formulations is required with regular monitoring and re-treatment of poles, where necessary, to maintain durability over time.

Keywords: *Chemical preservatives, distribution, penetration, retention, Tanzania*

2.1.3.5 Innovative documentation of nature-based solutions for enhanced technology transfer in horn of Africa

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Abstract

The Horn of Africa (HoA) is rich in biodiversity, which support many livelihoods. However, due unsustainable use of natural resources and climate change, the



region is experiencing unprecedented landscape degradation, desertification and biodiversity loss. Options to address these challenges include accelerated technology transfer of existing Nature Based Solutions (NBS). Knowledge and adoption of existing technologies is hampered by inadequate access to appropriate information. To enhance technology transfer in HoA, the Africa Initiative for Combating Desertification was developed in 2016 for implementation in; Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan and Sudan. One aim of the Initiative was to document good practices in natural resources management from each participating country for widescale dissemination. Terms of Reference (TOR), and tools for identifying, collecting, and documenting good practices in NBS were developed and adopted. Through a structured questionnaire administered to key farmers, information was captured on; problem addressed, specifications, applicable environment, application procedure, and impact of identified technology. Applying criteria for identifying good practices, technologies widely adopted were documented. The technologies included those addressing; landscape and soil degradation, woodfuel shortage, pasture development and livelihood options. These technologies were found to meet farmers immediate needs, were easy to learn, environmentally friendly and economically viable. Use of prescribed format for collection and documenting technology ensured uniformity in data collection, detailed description of the technology which would promote replication across countries. The information collected was then synthesized into information materials such as books, manuals, guidelines and brochures, which were shared through internet and non-internet-based platforms. The survey demonstrated that many technologies exist across HoA but they need to be innovatively documented in a farmer friendly format to scale up adoption as well as create awareness of their existence and thereby avoid duplication of efforts in their reinvention and verification.

Keywords: *Adoption, desertification, knowledge-sharing, landscape, resilience*

2.1.3.6 Innovation and technology in forest and beekeeping industries: Mau forest in Kenya

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Abstract

The Mau Forest, Kenya's largest forest complex, plays a critical role in ecological sustainability and the livelihoods of communities relying on forest resources. Two significant sectors within this region are forestry and beekeeping, both of which face challenges due to environmental degradation, population pressure, and climate change. This paper explores the innovative approaches and technologies being employed to promote sustainable practices in these industries. In the forestry sector, technological innovations such as Geographical Information System (GIS) mapping, Remote Sensing for forest monitoring, and sustainable forest management techniques have been adopted to curb deforestation, enhance conservation, and improve ecosystem services. Additionally, agroforestry practices and community-based forest management models have been integrated to ensure balanced resource use. In the beekeeping sector, modern technologies and innovations are being introduced to improve productivity, quality, and market access for honey and other bee products. The adoption of modern beehives such as Langstroth and top-bar hives, coupled with training on improved hive management, has significantly boosted honey yields. The use of mobile apps for market linkages and traceability, as well as innovations in harvesting and processing techniques, is also transforming the sector. This paper critically examines the socio-economic impacts of these innovations on local communities, particularly in enhancing income diversification and food security. Furthermore, it assesses the environmental benefits associated with sustainable beekeeping practices, such as pollination services that contribute to biodiversity conservation. Through qualitative and quantitative data, this study highlights the challenges and opportunities in integrating modern technologies into traditional practices in the Mau Forest region. It emphasizes the importance of policy frameworks, community engagement, and capacity-building initiatives to ensure the long-term sustainability of these industries. The findings offer insights into how innovation can bridge the gap between conservation efforts and livelihood improvement, contributing to broader goals of sustainable development and climate resilience in Kenya.

Keywords: *Sustainability, conservation, beekeeping, forestry, technology*



2.1.3.7 A systematic mechanism for reporting illegal activities in the Eastern Arc Mountains of Tanzania

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Abstract

The ability of forests to provide forest products and services to society sustainably is hampered by forest illegalities such as illegal logging and agriculture encroachment. In Eastern Arc Mountains (Excluding South Nguru), forest illegalities resulted to a decline of 129,420 ha of forest between 1955 and 2008. Thus, this study was implemented in the Amani, Magamba, Nilo, Uluguru, Mkingu, Kilombero, Uzungwa Scarp and Chome nature forest reserves, and Udzungwa National Park (NP) to develop a systematic mechanism for reporting illegal activities that will enable responsible authorities to curb illegal activities in the Eastern Arc Mountains. The study assessed existing reporting mechanism of illegal activities in the EAMCEF target sites and developed a mechanism for reporting illegal activities, and evaluated its performance. Results indicated that unwanted wildfires, logging and animal hunting with score 28% were the leading illegalities in the NRs and NP. Main means of reporting illegal activities were text messages and calls (28%), in person reporting (31%) and phone call or in person (38%). This implies that majority of villagers reported illegal activities using phone calls and in person, which was non-confidential. Some of the respondents (29%) reported that there were no systematic way of reporting illegalities and reporting was done to any leader who is easily reachable. About 56% of the respondents said there were no feedback to them on the action taken to the accused persons, and 24% they did not know anything concerning reporting and feedback. To address these challenges, a systematic reporting mechanism was developed and piloted. Furthermore, the mechanism addressed most of the challenges that were identified in this project and displayed outstanding results against the previous used reporting methods.

Keywords: *Nature forest reserves, national park, reporting mechanism, illegal activities reporting, eastern arc mountains*



2.1.3.8 Potential of geospatial technologies in mechanized timber harvesting planning at Sao Hill Forest Plantation, Tanzania

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Abstract

Mechanized timber harvesting incorporates various activities including; road planning and layout, selection of harvesting systems and machineries to be used. Emergence of geospatial technology (GSPT) in the recent decades, has become useful tools for planning timber harvesting in plantation forests. GSPT provides precise stand information mainly applied in optimizing forest operations. This study was conducted at Sao hill Forest Plantation (SHFP) Tanzania, with the objective of determining relative efficiency (RE) between geospatial approach (GSPA) and conventional approach (CA) on planning mechanized timber harvesting. 120 grapple skidder (GS) observations in 30 sample plots covering different spatial terrain were studied. In both approaches, productivity and costs were predicted using generalized linear model (GLM). To extrapolate productivity and costs for the entire harvested area, Inverse Distance Weighted (IDW) interpolation was performed. The results showed that, GSPA has higher productivity and lower unit skidding costs (i.e., 71.1m³/hr and 2.121USD/m³) compared to CA (i.e., 67.5m³/hr and 2.914USD/m³) respectively. Skidding distance and slope (p-value < 0.05) were significant predictors of the GS in both approaches. The pseudo R² ranging from 58.1% to 64.3% under CA, and 62.9% to 60.8% under GSPA. Likewise, relative root means square error (RMSEr) under conventional models (CM) ranged from 49.3% to 50.4% and 33.4% to 35.2% under geospatial models (GSPM). Generally, the results showed that, models under GSPA have better fits and accuracy, compared to CA. Moreover, computed RE values (i.e., 1.18 and 6.17) indicated that parameter estimates for the GS productivity and costs were more precise under GSPM compared to CM. These findings highlight the potential of GSPT for an efficient large scale timber harvesting planning, by considering terrain constraints.

Keywords: *Convectional, geospatial, grapple skidder, productivity, costs, relative efficiency*



2.1.3.9 Mixed hive systems to enhance stocking and management of bee colonies in different forest landscapes of Tanzania

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Abstract

In Tanzania, hive systems in use include logs, top bars and frames, each with pros and cons regarding management and production. It is evident that honey and beeswax available in the country's market chains are collected from log and top bar hives. The challenges faced the beekeeping industry at production level include low occupancy rates, durability of less than five years, and a lack of interchangeability. This study was conducted to establish a mixed system of top bars and frames within a box hive, as well as to design a standard cylindrical hive. Three carpentry workshops were utilized at different times: one at Sao Hill Forest Plantation in Iringa, and two in Dar es Salaam - Fine wood works limited and individual carpenter. The designed mixed hive systems consist of sized frames and top bars that fit both top and frame hives, a catcher box combining of top bars and frames, and cylindrical octagonal hives with their respective catchers. The systems were tested in three different areas: Mufindi, Iringa, and Mwanga districts, demonstrating the advantage of interchangeable and the ability to transfer swarm of bees from catcher to the hive. Additionally, the mixed hive systems have standard measurements that can be replicated to carpenters and interested beekeepers. It is recommended to introduce mixed hive systems to small holder beekeepers in various foraging habitats to test the acceptance of good beekeeping practices and production efficiency.

Keywords: *Mixed hive systems, interchangeability, stocking of bee colonies, smallholder beekeepers and foraging habitats*



2.1.3.10 Simulation of stand dynamics for Miombo woodlands in Kitulangalo Forest Reserve, Morogoro, Tanzania

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Abstract

Miombo woodlands constitute the most extensive type of forest cover within South and East Africa, Tanzania in particular, and they are seriously threatened by intensive degradation and deforestation. The dynamics of miombo stands were examined in this study using a simple simulation system applied to experimental stands at the Kitulangalo Forest Reserve (KFR) in Tanzania. Prediction of tree-level diameter increment, mortality, and ingrowth across species groups with empirical models based on data from experimental sites constituted the essential elements of the simulation system. Diameter distribution, stand basal area, volume yield, and above-ground biomass accumulation were assessed in three harvesting alternatives across three species groups. The results indicate a high degree of positive response to careful selective harvesting in lightly degraded, recovering miombo forests. Simulation systems compiled from experimentally based models seem promising as tools for research on stand dynamics and sustainable management alternatives in miombo woodlands.

Keywords: *Simulation, stand dynamics, diameter increment, harvesting alternatives, miombo woodlands*



2.1.3.11 Four new Tanzanian plant species of the genus *Sansevieria* (Family *Asparagaceae*), threatened in the wild

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Abstract

Studies on the largely East African genus *Sansevieria* are relatively few, apart from the most prominent Flora of Tropical East Africa (*Dracaenaceae*) which describes 25 Tanzanian species. Many groups of plants in Tanzania require further study, particularly succulents, which are difficult to dry and preserve specimens. We describe four *Sansevieria* species previously unknown to science from four regions of Tanzania. After their collection as living specimens, the plants studied were all cultivated in open ground beds at Tanzania *Sansevieria* Foundation (TSF) premises on the slopes of Mt Meru, Arusha, Tanzania, at Seela Sing'isi village at an elevation of 1285 m above sea level (asl). Traits for inflorescences, flowers and leaves were recorded following a detailed systematic scheme. Leaf surface texture was studied using a hand lens (12 x,) under natural or artificial sidelight. The two species in Subgenus *Capitulatus* are *S. marumaru* and *S. tonyae*. These two were determined as critically endangered (CR). The other species in Subgenus *Sansevieria* are *S. babatiensis* determined as Vulnerable (VU), and *S. tembo* which appears to be extinct in the wild. Recent field expeditions support the contention that Tanzania is probably the centre of distribution for this genus, as well as the country with the most *Sansevieria* species. There are more than 50 collections in the Foundation's living collection that are likely to be described as new to science. The locations of these four new species are examples of the many places where conversion of natural vegetation for agriculture and other purposes is accelerating. This work calls for urgent conservation actions to halt the loss of these species and others that are likely to become extinct.

Keywords: *Conservation status, new taxa, Sansevieria.*



2.1.3.12 Strengthening integrated Agroforestry in East Africa: A climate-smart approach for addressing decreasing yields, unstable markets, and unpredictable weather for smallholder farmers

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Abstract

Shifting weather patterns and extreme weather events as a result of changing climate will adversely affect crop yields in East Africa contributing to food insecurity and unstable livelihoods among other biodiversity impacts. Multiple studies indicate that East Africa could lose as much as 40% of its crop production by the end of the 21st century. Agroforestry can have a vital role in building climate resilient food systems that can buffer the effects of food security through crop diversification while improving people's lives through the sale of tree products and surplus crops. Although agroforestry can provide a triple win for climate, biodiversity, and well-being economic uncertainty stymies adoption. In the interest of supporting communities to transition to more resilient agricultural systems, The Nature Conservancy is working with partners in Kenya and Tanzania to strengthen agroforestry to improve people's livelihoods, intensify conservation impacts, and tackle climate change. A pilot agroforestry scheme has been established across six landscapes demonstrating the value of (i) alley cropping (ii) boundary planting (iii) enrichment furrow (iv) orchard planting, and (v) dispersed planting design. A carbon project is simultaneously being developed as a strategy for sustainable financing mechanisms for smallholder farmers. Free, Prior, and Informed Consent (FPIC) is used to seek consent and to mobilize smallholder farmers and other stakeholders. The program has planted more than 600,000 trees using various agroforestry planting designs covering close to 88,000 ha. Approximately 30,000 smallholder farmers are enrolled and benefiting from the program. The pilots are serving as fertile ground for developing new tools and testing mechanisms for estimating the carbon benefits of different agroforestry systems. Quantifying the economic returns of agroforestry to smallholder farmers is necessary to drive adoption and enable scaling up.

Keywords: *Agroforestry, climate change, climate smart agriculture, livelihood, food security*



2.1.3.13 Antibacterial activity of Hydrogen Peroxide-Free *Apis mellifera* honey from selected vegetation types in Tanzania

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Abstract

Honey devoid of hydrogen peroxide exhibits remarkable antibacterial properties, rendering it highly valuable for medical applications. Despite the global recognition of Tanzanian honey's quality, there is a paucity of information regarding its non-peroxide antibacterial activity, which hinders informed consumer choices. This study investigates the antibacterial efficacy of hydrogen peroxide-free *Apis mellifera* honey from eight vegetation types commonly used for beekeeping in Tanzania. A total of 110 honey samples (400 ml each) were collected for analysis. From these, three samples exhibiting antibacterial activity were randomly selected from each vegetation type as replicates to evaluate their non-peroxide effects against *Staphylococcus aureus* and *Salmonella typhi* through agar well diffusion method. Hydrogen peroxide levels in the experimental group were reduced using the catalase enzyme while the control were not. Additionally, *pH*, total phenolic content, and flavonoid concentrations were quantified using standard methods. Data analysis involved ANOVA and Tukey's test, with significance established at $p < 0.05$. The *pH* values ranged from 3.39 ± 0.27 to 4.09 ± 0.31 , total phenolic content varied from 115.41 ± 25.87 mg GAE/100 g to 269.97 ± 90.63 mg GAE/100 g, and flavonoid levels ranged from 6.71 ± 5.90 mg QE/100 g to 137.98 ± 154.31 mg QE/100 g. Results indicated that all non-peroxide honey samples demonstrated significant inhibition zones for both bacterial strains, with the highest (>10 mm) antibacterial activity observed in honey from Riverine and Swampy vegetation, and the lowest (<10 mm) in Mangrove vegetation. There was no significant difference in antibacterial activity between the experimental and control groups. These findings underscore the potential of Tanzanian honey as a natural antimicrobial agent whether devoid of hydrogen peroxide or not. Further research is required in identifying the phenolic compounds responsible for antibacterial activities in honey from the studied vegetation types.

Keywords: Antibacterial, Hydrogen-peroxide, vegetation



2.1.3.14 Dilemma for the Sustainability of Wood-Based Industries in Tanzania

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Abstract

A study was conducted to establish the status of the wood-based industries and their optimal productivity level, types of raw materials used, their sources and quantity, trends of consumption of raw materials for primary wood-based industries and the capacity of forest resources to sustain raw materials demands for the industries in Tanzania. The study involved five zones of forest management namely; Southern Highlands, Western, Central, Lake and Northern. Data collection methods involved desk review, interviews, resource mapping, and remote sensing. A total of 1,487 primary wood based industries were recorded, comprised of Sawmills, Wood/pole treatment plants, Wood panel boards, Pulp and paper and other wood products (charcoal briquettes & wattle extract), and power source (generation of electricity) with most of these industries sourcing wood raw materials from public forest plantations and individual woodlots. Among the wood-based industries, 592 (40%) were recorded in the Southern Highland Zone. Annual total wood demand in the studied zones was 7,172,596.00 m³, whereas the supply was 2,155,976.00 m³ (30%), making a deficit of 70%. Forest plantations and woodlots are mainly constituted of tree species from six tree genera; *Eucalyptus*, *Pinus*, *Tectona*, *Grevillea*, *Cupressus* and *Acacia* varying from one place to another based on climatic condition and edaphic factors. A total of 281,943.12 ha of forest plantations were estimated in the studied zones with 207,320 ha (74%) found in the Southern Highlands Zone. Major roadblocks facing the sustainability of forest plantations and wood based industries included harvesting of immature trees on-farms and woodlots, pest and disease, fire outbreaks, poor access roads to the raw materials, the influx of primary wood based industries that focused only on sawmills, and lack of reliable market for some of the plantation species. The study revealed that the supply of raw materials was not enough to sustain the demand for the existing wood-based industries. Thus, more efforts are needed to establish more tree woodlots and plantations to sustain the existing wood-based industries in the country.

Keywords: *Wood-based industries, forests, plantations, woodlots, sawmills*



2.1.3.15 A satellite-based monitoring deforestation of thickets ecosystem of Semi-Arid area of Tanzania

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Abstract

Thickets in Tanzania represent a unique and critical ecosystem characterized by dense, spiny vegetation that supports various biodiversity. This ecosystem is home to numerous endemic plant species and serves as an essential habitat for various wildlife, including historically significant populations of elephants. It also supports local livelihoods by providing valuable resources such as honey. However, this important ecosystem faces several challenges threatening its sustainability including deforestation driven by agricultural, and settlements expansion leading to significant thicket loss. The lack of formal protection for most thicket areas leaves them vulnerable to exploitation. This study utilizes satellite-based remote sensing to monitor deforestation in the thickets ecosystem. This research aims to provide timely data to inform conservation strategies and policy-making. The study employs satellite imagery from Landsat 8 spanning a period from 2018 to 2022. A supervised classification approach using the Random Forest algorithm was applied to distinguish between forested and deforested areas. Ground truth data was collected through field surveys to validate the classification results. The results indicated an overall accuracy of 92%, whereby about 307,407 ha of thickets are found in the Singida region (57% in Manyoni and 41% in Ikungi districts). The results indicate a significant reduction in forest cover over the study period, with an annual deforestation of 61,000 hectares. This implies that if the situation remains unchecked within 5 – 10 years, the thickets will be depleted. In addition, areas where thickets have deforested an emergence of invasive plants known as *Acacia mangium* was observed. The findings highlight the urgent need for targeted conservation efforts and sustainable land-use practices to mitigate further loss of thicket cover. Thicket monitoring, as demonstrated in this study, will improve conservation programs and aid in the conservation of the remaining pristine thicket ecosystems to ensure the long-term conservation to meet ecological and socio-economic values.

Keywords: *Biodiversity, conservation, earth-observation, landsat-8, thicket*



2.1.3.16 Simulation modelling for industrial and services: Application of Computer Simulation technique to Optimize Wood Panels Production System

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Abstract

Simulation is frequently the technique of choice in problem solving. Nowadays computer simulation is being employed in many manufacturing organisations to design, develop, implement, and analyze manufacturing system's problem of interest. Using a valid simulation model gives several benefit and advantages in developing a better system and in predicting the system behavior under varying set of circumstances in order to improve the system performance. This paper is concerned with implementing a computer simulation model of a virtual wood panel production system to demonstrate the potential of the simulation technique. The model uses ARENA software whereas data handling was done using "Input Analyzer for Arena®", a package which selects the optimum stochastic distribution function to run a model of a dynamic system such as the panel manufacturing system. The Simulation model was used to identify bottlenecks in the system and to evaluate some of the possible alternatives to solve the problems. Changing the level of resources, adding extra workers, adding a shift, and use of overtime were tested as alternative methods to improve the current system performance.

Keywords: *Modeling and simulation, discrete event simulation, furniture production system and modular approach*



2.1.4 Forest and bee products value chains under climate change scenarios

This sub-theme has one keynote speaker and ten paper presenters which in total sum up to eleven presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Allsopp, M.	10
Paper presenters	Richard, A.K.	7
	Lasway, J.V.	7
	Lukiko, S.B.	11 & 15
	Tonya, E.	11
	Krausa, K.	11
	Mduda, C.	15
	Bloesch, U.	15
	Newa, N.	15
	Kagosi, P.	15



2.1.4.1 Promoting high bee diversity in Afro tropical drylands: The impact of agriculture intensification with seasonal fallow lands in Northern Tanzania

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Abstract

The exponential growth of the global human population and its subsequent rise in food demand have led to widespread agriculture, making it the dominant form of land use worldwide. Within Afrotropical drylands, this shift has resulted in the loss of natural savannah habitats and increased agricultural intensification, yet its consequences for bees remain largely unknown. This study, investigated the effects of agricultural intensification on bee assemblages in the northern Tanzanian Afrotropical drylands, while disentangling direct impacts from temperature and indirect effects mediated by floral resource changes. Data were collected from 24 study sites, representing three management intensity levels (natural savannah, moderate intensive, and highly intensive agriculture), spanning a wide gradient of mean annual temperature (MAT) in northern Tanzania. By employing ordinary linear models and path analysis, we examined the impacts of agricultural intensity and MAT on bee species richness, species composition, and body-size variation within bee communities. Findings revealed that bee species richness increased with both agricultural intensity and temperature. The effects of agricultural intensity and temperature on bee species richness were linked to the positive impact of agriculture and temperature on the richness of floral resources utilized by bees. Particularly during the off-growing season, agricultural land demonstrated an extensive period of fallow land, fostering a high density of



flowering plants with unique bee species composition. The increase in bee diversity in agricultural habitats also correlated with greater variation in bee body sizes, which, however, diminished in environments with higher temperatures. To conserve bee communities and ensure vital pollination services in the region, a balanced mixture of savannah and agriculture, with prolonged periods of fallow land, should be maintained.

Keywords: *Bee abundance, bee species richness, forage resources, mean annual temperature, species community composition*

2.1.4.2 Beekeepers' perception on arrangement supports for beekeeping activities in Tanzania

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Abstract

Beekeeping plays a major role in socio-economic development and environmental conservation. However, beekeeping potentials in Tanzania are not fully utilized. This paper presents beekeepers' perspectives on the support arrangements used by various organisations to facilitate beekeeping activities in Tanzania. The research was conducted in four regions of Tanzania (Singida, Geita, Tabora, and Kigoma). Data were collected using several methods, including: Focus Group Discussions (FGD), Key Informant Interviews (KI), Desk reviews, Questionnaires, and Field observations. The results indicate that 56.6% of the projects were supported by the Tanzania Forest Fund (TaFF). Further, most (88%) of supporting institutions provided in-kind support like equipment rather than direct funding to avoid challenges associated with funds management. Even further, in nomination of beneficiaries, the most preferred arrangement was selection by involving local government authorities and local communities, focusing on basic factors like beekeeping experience and potential beekeepers. In addition, all supporting institutions provided training to beneficiaries but monitoring and evaluation approaches varied among the supporting institutions. Only TaFF and Commission for Science and Technology (COSTECH) used open calls for proposals. Beekeepers expressed preferences for group-based support, grassroots-level



beneficiary selection, in-kind assistance instead of funds, and continued monitoring even after project completion. The findings suggest that the sustainability of beekeeping projects is linked to support arrangements that align with beekeepers' preferences.

Keywords: *Beekeepers' perception, support arrangements, supporting institution, beekeeping, Tanzania*

2.1.4.3 Types, sizes, and spatial distribution of beehives in Tanzania: Implications for honey production in Tanzania

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Abstract

The Tanzania Government aims to enhance hive productivity and protect honeybees through improved hives. However, the existing hives face low productivity challenges. This paper presents the suitability of different hive types and sizes on honey production across Tanzania agro-ecological zones and challenges beekeepers face in managing these hives. The study was conducted in 21 districts that are underexplored for their beekeeping potential, engaging 234 beekeepers. Data on hive productivity and management challenges were collected through interviews, while hive sizes were measured directly. Analysis was performed using Excel and R software. Results revealed that 51% of respondents use top bar hives, followed by traditional hives (37%). Notably, 30% of respondents lack knowledge in managing improved hives. Significant size variability was observed in hive types both within and across agro-ecological zones. Annual production varied significantly, with top bar hives yielding between 11.8-21.5 kg, log hives between 12-28 kg, and bark hives between 10.5-20 kg. The highest production from top bar hives was recorded in the Lake zone, followed by the Southern Highlands. The variations in production can be attributed to geographic factors, differences in hive types, and management practices. The study recommends conducting targeted workshops for beekeepers to enhance their



knowledge on improved hive management techniques, focusing on practical training related to specific hive types suitable for various agro-ecological zones, and emphasizing the importance of best practices in colony health and productivity.

Keywords: *Agro-ecological zones, hive types, honey production, management challenges*

2.1.4.4 Chances and challenges of apitourism in Tanzania

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Abstract

Tanzania, Africa's second-largest honey producer, boasts a rich beekeeping tradition that extends beyond honeybees and includes a diverse range of bee species, such as stingless and solitary bees. The beekeeping sector plays a crucial role in rural livelihoods and presents significant opportunities for growth. One promising avenue for development is Apitourism, which can leverage Tanzania's thriving tourism industry to create new revenue streams, support traditional practices and promote environmental conservation. Despite the potential benefits, there is currently minimal integration between the tourism and beekeeping sectors in Tanzania. Bridging this gap comes with challenges and the need to equip the beekeeping sector with the skills from the tourism sector and vice versa. Offering engaging Apitourism experiences, with intriguing storytelling and communication, and the provision of quality hospitality while ensuring guest safety are priorities. This presentation will discuss the opportunities and challenges associated with developing Apitourism in Tanzania, strategies to foster closer integration between tourism and beekeeping, and the potential to position Tanzania as a leader in this emerging niche market in Africa and prepare both sectors for the upcoming Apimondia 2027.

Keywords: *Apitourism, beekeeping tradition, honey*



2.1.4.5 Influence of vegetation on the physicochemical properties and sensory characteristics of honey produced by the western honeybee, *Apis mellifera* L in Tanzania

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Abstract

Honey is valued not only for sweetness but also for its diverse flavours and potential health benefits. The quality and characteristics of honey are significantly influenced by the flora available to the foraging bees. The vegetation types within a given environment play a crucial role in determining the physicochemical properties and sensory profiles of honey. This study investigates the influence of vegetation on the physicochemical properties and sensory characteristics of honey produced by the Western honeybee, *Apis mellifera* L, in five distinct vegetations: miombo woodlands, afro-montane, coastal mosaic, acacia and mangroves. Using standard analytical techniques, we assessed moisture content, pH, electrical conductivity, and color across samples from these environments. Significant variations were observed in moisture content (18.7 – 21.8%), pH (3.4 - 4.1), electrical conductivity (0.3 – 1.2 mS/cm) and color (69.5 – 124.8 mm Pfund) ($p < 0.05$). Sensory profiles also exhibited notable differences, reflecting the influence of diverse vegetation types. While most honey samples met established quality standards, mangrove honey did not satisfy criteria for water content and electrical conductivity. These findings enhance our understanding on the quality and sensory diversity of *A. mellifera* honey, with implications for its branding and marketability in the honey industry. It is recommended to develop branding that highlights the unique characteristics of honey produced from specific vegetation types. Use sensory profiles to differentiate products in the marketplace.

Keywords: *Apis mellifera*, honey quality, vegetation influence, sensory analysis, Tanzania



2.1.4.6 Stingless bee honey harvesting, processing, storage and compliance to quality standards in Tanzania

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Abstract

Stingless bees are increasingly recognised for their distinctive honey and ecological benefits. Tanzania is among the few countries in Africa where stingless bees are actively managed for honey production. Nonetheless, significant challenges persist in the stingless bee honey value chain. This mixed-methods study offers an overview of the practices involved in stingless bee honey harvesting, processing, storage, and adherence to quality standards within Tanzania. Through a combination of field observations, interviews, literature review and analysis of honey samples, this research identifies key practices, challenges, and opportunities in the sector. The findings reveal that while traditional methods still prevail, there is a growing adoption of modern techniques to improve honey quality and yield. However, achieving compliance with national quality standards remains an ongoing issue. The study underscores the need for targeted interventions to improve quality assurance and support sustainable development within the stingless bee honey industry. Recommendations are provided for policy enhancements, educational initiatives, and technological support to improve adherence to quality standards and foster sector growth.

Keywords: *Honey, stingless bees, value chain*



2.1.4.7 Determinants of pricing for sustainable honey production among bee-keepers in Tanzania

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Abstract

Sustainable honey production has some challenges from the techniques and the policies of a country on pricing practices. This paper was based on a literature review to evaluate the pricing of honey products for sustainable production in Tanzania. The paper used narrative design to investigate the determinants of honey pricing with the search words pricing, bee products, honey, and sustainable pricing. The paper reviewed 20 related papers on the pricing of honey and bee products in Tanzania. Despite the initiative to commercialize bee products, the pricing systems are not very well-known where prices depend on the buyer's side. The challenge with buyers determining prices dictates the prices, instead demand and supply need to be adopted. The study findings show that, there are challenges and opportunities for the prosperity of bee products including honey in the local and world markets. The study also, found that, beekeepers have deep indigenous knowledge contributing to the improvement of honey production for commercialization. In conclusion, the study views the establishment of a market network and the developing of its information delivery system for the honey producers to bring the encouragement via enhancing benefits to bee-keepers and production. The paper recommends for improvement of honey production based on demand and supply and be the basis for honey pricing to support sustainable production. Therefore, strengthening the apiculture best practices through research and consolidating the extension system, so as to solve the challenges, exploit the available opportunities and improve the marketing linkage for sustainable development.

Keywords: *Pricing, beeswax, challenges, honey, opportunity, apiculture*



2.1.4.8 Mushroom value chain development and forest conservation in Western Tanzania

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Abstract

Large parts of the Katavi-Ugalla and Rungwa River corridors in Tabora and Katavi regions in Western Tanzania are covered with extensive miombo woodlands. During the rainy season, fungi are abundant in these ecosystems and represent the second most important non-woody forest product (NWFP) after beekeeping. The aim of our study was to assess wild edible mushrooms and their socio-economic value in Inyonga and Sikonge districts based on ethnomycological surveys (KIs and FGDs at mushroom pickers and sellers level) in view of developing an added-value chain for wild edible mushrooms. According to first inventories over 50 edible species were identified together with the local communities. 40% of the interviewees are eating at least three to four times a week fresh mushrooms, while 77% of the interviewees are consuming at least once a week mushrooms. Moreover, 34% of the interviewees are consuming at least once a week dried mushrooms in the off-season. As a first step mushroom pickers were organised in producer groups which are incorporated into professional associations or cooperatives. At market level, there is a constant demand for mushrooms throughout the year. 32% of the retailers are selling mushrooms also in the off-season. The best-selling mushroom species are from three genera including Kansolele (*Termitomyces microcarpus*), Wange (*Cantharellus isabellinus* und *C. symoensii*), Usikobha (*Lactarius xerampelinus*), and Umpalala (*Lactarius kabansus*). Current regulations on mushroom picking in forest reserves and game reserves should be reviewed to create a legal framework that is more practical and supports promotion and commercialisation of wild edible mushrooms. Promoting wild edible mushrooms is an innovative approach to add monetary value to the Miombo ecosystem while encouraging surrounding communities to better protect the forest and thus contribute to mitigating climate change.

Keywords: NWFP, miombo, value chain, wild edible mushrooms



2.1.4.9 Community awareness on Propolis production and use for its promotion to support restoration of forest resources in Tanzania

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Abstract

Propolis/beeglue is a natural resinous mixture that honeybees produce building and sealing material as well as a defensive agent coating the inner walls of the beehive. Globally, propolis is a very important bee product with wide range of uses including medicinal values for human and domestic animals. Lukiko (2023) Tanzania Propolis has significant higher quality potential antibacterial activities and antioxidants indicating that the product has promising potential market to be exploited in the country. However, there is scanty information at community level regarding propolis production, value and uses. This study assessed the awareness on propolis production from 20 supporting institution and 40 beekeeping groups in Tanzania main land. Data were collected using questionnaire, focus group discussion and key informants interview methods. The findings reveal that most beekeeping support organisations focus on honey and wax production, with minimal attention given to propolis. Furthermore, it was observed that some beekeepers discard propolis during hive inspections or harvesting due to a lack of awareness about its market value. In addition, only 10% of respondents actively harvested propolis, and even then, they used traditional hives which are not specifically designed for propolis production. The main reasons cited for not engaging in propolis harvesting were lack of knowledge about the product (80%) and a lack of awareness of its market value (20%). Those who use propolis typically employ it for baiting, sealing domestic utensils, or treating health issues such as ulcers. The study emphasizes the need for government intervention to raise awareness among beekeepers to harvest propolis commercially feeding emerging pharmaceutical industries for the economic development and environmental conservation.

Keywords: *Propolis production, restoration of forest resources, Tanzania*



2.1.4.10 A review of honey bee gut microbiota characterization and genomics in Africa

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Abstract

Honey bees play a vital role in honey production and pollination, but their health is threatened by various factors such as diseases, pests, pesticide exposure, and climate change, leading to widespread colony losses worldwide. The gut microbiota, a crucial component of honey bee health, is also affected by these same factors. Over the last decade, numerous studies have documented the essential roles that gut microbiota communities play in ensuring the ecological success of honey bees, from nutrition to immunomodulation. The western honey bee, *Apis mellifera mellifera*, harbors a distinct and specialized gut bacterial microbiota dominated by eight to nine core bacterial phylotypes, including *Snodgrassella alvi*, *Gliamella apicola*, *Bartonella apis*, *Frischella perrara*, *Lactobacillus Firm-4* and *5*, and *Bifidobacterium asteroides*. Most studies have characterized the gut bacteria of the western honey bee and briefly studied the genomics of these crucial microbiome components. A few studies have reported on the gut microbiota and genomics of African bee races in countries such as Egypt, Nigeria, Kenya, Namibia, and South Africa. This review explores the current understanding honey bee gut microbiota and their influence on honey bee health and colony losses, with a focus on the African honey bee races.

Keywords: *Genomics, honey bee, microbiota*



2.1.5 Gender perspective in forest and beekeeping industries

This sub-theme has one keynote speaker and two paper presenters which in total sum up to three presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Augustino, S.	14
Paper presenters	Mwalewa, S.	3
	Msalilwa, U.L.	3



2.1.5.1 An overview of gender perspectives in forestry and beekeeping industries

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Abstract

The forestry sector worldwide has remained one of the most gender segregated labour forces, despite gender equality been addressed in late 2000s. The use of forest resources has been influenced by social rules and customs developed by community over time, with gender norms being one of the most important determinants of access to, use of, and control and management of forests resources. Gender outlooks are imperative in the forestry industry due to considerations on how different situations impact men, women, and other disadvantaged groups. However, women's role has been invisible and unrecognised, and the sector is perceived as a predominantly male domain, especially with regard to the production and commercialization of high-value forestry products. Across the globe without excluding Tanzania, challenges still exist in the forest sector as far as gender equity and equality is concerned which require urgent attention to ensure sustainable development of its industries including the beekeeping. Women further, are heavily involved in forest work including processing of secondary wood products. Women's wages in the forestry industry are often not equal to those of men. Women's working conditions in the forestry industry are often poor. There is a need to support both men and women to have equal opportunities in forest industries and beekeeping including value-added product training. Emphasis to change this should not be as simple as just increasing the number of women working in the forestry industry and beekeeping; but rather need for reconsideration and reflection on gender competence, core business and competitiveness.

Keywords: *Forestry and beekeeping industry, Women, Gender perspectives, Tanzania*



2.1.5.2 Gender perspective in beekeeping value chain in Kitui County, Kenya

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Abstract

Kenya has a great potential for honey production and other hive products especially in Arid and Semi-Arid Lands (ASALs). The ASALs are rich in flora that is important for bee forage. Kenya produces 100,000 metric tons of honey which is a source of employments to about 547,440 persons. The beekeeping value chain in Kenya presents a unique intersection of gender dynamics, significantly influencing the participation and economic outcomes for men and women. A study was carried out in Kitui County, Kenya to identify factors influencing men and women participation in beekeeping. Data was gathered from 200 smallholder farmers and key informants selected through purposive sampling targeting beekeepers. Semi-structured questionnaire, key informant checklist and Focus Group Discussions checklist were used to collect data. The results revealed that of the 200 respondents, 69% were male and 31% female. Sixty-five percent (65%) of men were actively involved in both traditional and modern beekeeping while the remaining were involved in modern beekeeping. On the other hand, 75% of women were involved in modern beekeeping. More men (73%) were involved in hanging of beehives, apiary management and harvesting of honey. While women (70%) were involved in processing and marketing of the bee products. Further, the study established lack of capital, recurrent drought, attack by pests and predators, low prices and inadequate extension services, as constraints to adoption of the entire beekeeping technology. Women participation was further constrained by cultural norms and gender roles. Beekeeping was found to encourage tree planting which promotes conservation of the environment. Women involvement in beekeeping is still low but it can be enhanced by making modern beehives more accessible and encourage adoption of modern honey harvesting methods. The study recommends capacity-building, access to credit, formation of cooperatives, promotion relevant policies in all stages of the beekeeping value chain.

Keywords: *Bee keeping, gender, market, value chain*



2.1.5.3 Women's engagement in the timber value chain nodes in East African Community

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Abstract

Timber is an important sector in Sub-Saharan Africa (SSA) including the East Africa Community (EAC). Women's engagement in the timber value chain in the EAC has been a challenge for a long time. Despite recent literature suggesting women increase in involvement in timber value chain nodes, scientific information on their extent of involvement remains limited. This study was carried out to assess women's engagement in timber value chain nodes and capture the actual situation in Kenya, Tanzania, and Uganda. Specifically, the paper highlights the existing gaps in enabling environment for women in timber value chain - planning in EAC strategies, policy and legal frameworks; and mapping out the key players and their roles in the timber value chain. A cross-sectional research design was used for data collection. Data collection was carried out by reviewing the existing literature and interviews with 90 timber stakeholders in the three countries. The results showed that strategies, policies and legal frameworks support women to be involved in the timber value chain nodes. Women's engagement in the timber value chain in the EAC was significantly difference. Furthermore, women's were observed to participate in different timber value chain nodes in each country. About 83% of the women were involved in the retailing node in the timber value chainnodes. It is recommended that awareness raising on legal frameworks, timber modern operations machines and business management in the timber value chain nodes in each country is crucial to increase the involvement of women in the timber value chain.

Keywords: *Women, engagement, timber value chain, East Africa*



2.1.6 Green and blue economy policy and governance

This sub-theme has one keynote speaker and two paper presenters which in total sum up to three presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Bakengesa, S.S.	22
Paper presenters	Mwamakimbullah, R.	19
	Ngaga, Y.M.	19



2.1.6.1 Contribution of forest policy frameworks in achieving green and blue economy national targets: Experience from Tanzania

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Abstract

Like in many other countries, Tanzania is faced with climate change challenges notably increased drought, erratic rainfall and floods. The current climate vulnerability and future climate change impacts are significant enough to slow down the country in achieving key economic growth, sustainable development and poverty reduction targets. Currently about 14% of land (12,330,723 ha) is classified as highly degraded land and hence requires deliberate efforts to restore it. Already the country has committed to restore 5.2 million ha through FRA 100, encouraging investment in forest industries through low emission engineered wood products and afforestation programme. The fate of the remaining 7.1 million ha rests on the capacity to make use of the available opportunities provided through existing policy frameworks. The Nationally Determined Contribution (NDC) targets on mitigation and adaptation are geared towards building resilience to the impacts of climate change and contribute to the global efforts in combating climate change in which forest sector has a role to play. The presence of Agroforestry Strategy, Landscape restoration strategy, Bamboo development strategy, Community Based Forest Management strategy and action plan, Beekeeping development Strategy, Non Timber Forest Products Strategy and Frameworks to support Farm Forest Producer Organisation to mention few, provide the required opportunities. Collaborative stakeholder's efforts to take up restoration opportunities and interventions will help the country achieve its green and blue economy targets for resilient landscapes and improved livelihood is recommended.

Keywords: *Nationally Determined Contribution, greenhouse gases (GHG), enabling policy frameworks, mitigation and adaptation, restoration.*



2.1.6.2 Overview of the Tanzania's forest sector contribution to economy, emerging challenges, opportunities and way forward

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Abstract

Forest sector plays a critical role in supporting the country's economy and development, offering a wide range of benefits, including the direct and indirect contributions to Gross Domestic Product (GDP) and employment opportunities, ecosystem services, and the promotion of rural livelihoods. In order to highlight on the sector management and its contribution to economy both primary and secondary data were collected appropriate to describe the sector situation at both the macro and micro levels. Input-output and value chain analyses were employed. The study found that the per capita forest size has fallen from 1.7 ha in 1990 to 0.82 ha in 2010; and down to 0.80 ha in 2022 and is further projected to fall to 0.35 ha by 2030. It was revealed that the forest sector role to economy was indicated by its contribution to value added, employment number and the balance of trade. In terms of value added, the study found that in 2019 the sector contributed Tanzanian Shillings (TZS) 4.65 trillion to Gross Value Added which was 3.3% share of GDP in the year (TZS 139,893,804,125,675). The sector faced management challenges including deforestation and forest degradation estimated at 577,000 hectares annually changing from forest to non-forest for the period 2013-2018, weak enforcement of policies, limited investment in manufacturing of secondary and tertiary wood products and in implementation of sustainable practises, climate change, land uses conflicts and limited financial resources. However, opportunities for the sector included the promotion of ecotourism, engagement of partnerships, technological innovations, carbon trading and Reduced Emission from Deforestation and forest Degradation (REDD+) initiatives, and, investing in training and capacity building. The study recommends that in order to enhance the forest sector's contribution to the national economy and development, strategic actions including promotion of sustainable forest management by strengthening policy implementation and securing of more funding for forest management initiatives and investment in manufacturing of secondary and tertiary wood products is essential.

Keywords: *Forest sector, gross domestic products, Tanzania.*



2.1.6.3 Enhanced efficiency of operations in the sawn timber value chains: A move to support the economy, curb deforestation and support climate change mitigation initiatives in Tanzania

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Abstract

This study evaluated the efficiency on various operations in the sawn timber value chain (i.e. forest management, logging, transportation, sawmilling and trade in sawn timber in Tanzania). The aim was to gain a better understanding of the state of the value chain and detect weak areas to inform strategies towards improving this sector, more so curbing deforestation and supporting of Climate Change Mitigation Initiatives. Collected data was analysed using a Data Envelopment Analysis to empirically measure the technical efficiency of processes in the value chain. The average results show that operations in the value chain operated below optimal levels, i.e. were technically inefficient. The average technical efficiencies in forest management, logging, log transportation, sawmilling and timber trading were 0.73; 0.97; 0.94; 0.80 and 0.75, respectively. Operations in forest management, sawmilling and timber trade theoretically, have a chance to improve their performances by 27%, 20% and 25% respectively. These results show that there is room for efficiency improvement in the operations of the value chain. Areas of improvement could include increase in forest stands' productivity, use of better technologies, value addition and personnel skill enhancement across the chain.

Keywords: *Efficiency, deforestation, value chain, value addition*



2.1.7 Clean energy solutions for sustaining forest landscapes

This sub-theme has one keynote speaker and three paper presenters which in total sum up to four presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Ngoo, G.	26
Paper presenters	Mramba, N.R.	23
	Latta, G.	23
	Kessy, J.F.	23



2.1.7.1 Clean energy solutions for sustaining forest ecosystems in Tanzania

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Abstract

Tanzania's forests, face rapid deforestation, losing 469,000 ha annually due to among others unsustainable biomass harvesting. Charcoal production alone has caused a 30% forest loss, risking total depletion within 50-80 years. To address this, the government and agencies are exploring clean energy solutions for sustainable economic, social, and environmental benefits. The government of has prioritised energy sector with huge ambition to mobilize investments particularly for clean energy solutions to strengthen energy production and use in-line with SDG goals. This paper highlights current clean energy solutions to alleviate pressure on forest ecosystems, reviews key challenges, and identifies research gaps to inform effective policies and programs, aiming to balance livelihoods with forest conservation for long-term sustainability. Data were collected using two main methods, including desk review of documents in and around the sector, including those from the energy sector, clean cooking subsector, environment, forestry and biodiversity. The second methodology used key informant interviews with energy stakeholders mainly members of TACCS, TAREA. Adoption of improved cook stoves reduced firewood consumption by 50%, while solar, and biogas systems provided viable alternatives for household energy needs. Forest loss rates decreased by 35% in communities with access to these technologies. Additionally, households reported improved health outcomes due to reduced indoor air pollution and saved an average of 30% on energy-related expenses. Barriers to adoption included upfront costs and limited awareness. Scaling up clean energy solutions through targeted awareness and capacity building programs, multisector approach, subsidies, and integration with agroforestry and fuelwood plots initiatives is essential for sustaining forest ecosystems.

Keywords: *Clean energy, deforestation, forest conservation, livelihoods, Tanzania*



2.1.7.2 Towards formalizing wood charcoal businesses in Tanzania: An exploratory investigation

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Abstract

Wood charcoal serves as the primary energy source for millions in Tanzania, with over 80% of the urban and peri-urban population relying on it for cooking. The demand for charcoal is expected to escalate with the country's rapid population growth, driven by factors such as poverty and limited access to alternative energy sources. Despite its vital role in the economy, wood charcoal businesses operate largely in the informal sector, hindering their sustainable and efficient contribution to both the government and individual economies. Informal enterprises, lacking formal recognition, fail to contribute to tax revenue and GDP, remaining small-scale with limited productivity and financial access. Consequently, overall economic growth remains constrained. This proposed research aims to design a business model for formalizing the wood charcoal sector in Tanzania, facilitating its integration into the formal economy and fostering sustainable development. The findings of this research will provide crucial insights for policymakers and decision-makers in governments and other stakeholders responsible for forest management. Furthermore, it will aid revenue collection agencies in strategizing their priorities for the mutual benefit of both businesses and the government.

Keywords: *Wood charcoal, informal, forestation, sustainability*

2.1.7.3 Assessing sustainability impacts of increased harvest for firewood and charcoal production in mainland Tanzania

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Abstract

Tanzania's fuelwood harvest, comprising firewood and charcoal production, accounts for over 90% of the country's estimated total forest harvest, and is already causing severe deforestation in several areas of the country. However, quantified assessments of the sustainability of this harvest are lacking both at regional and national levels. In this study, we analyze impacts of future fuelwood demand scenarios for mainland Tanzania on the regional and national forest growing stock, annual harvest and price of charcoal – all interesting and interrelated indicators of forest sustainability. This is done by applying a new dynamic partial equilibrium model which links supply and demand for firewood, charcoal, sawlogs, pulpwood and forest industry products in each of the 25 regions of mainland Tanzania. The model (TanzFor), is the first of its kind in Africa, and integrates regional wood supply based on detailed forest data from 15,180 sample plots in Tanzania's national forest inventory (NAFORMA) with wood demand based on regional prognosis for economic growth, population growth, urbanization rates, technological improvements, and costs of transport and production. The study reveals alarming negative impacts on future forest growing stocks, caused by strong increases in the consumption of firewood and charcoal. The main drivers are high population growth and urbanization rates, low availability of alternative energy sources for cooking, and relatively free access to land as a common pool resource. TanzFor seems interesting for application in several other types of research related to forest sustainability in Tanzania, like further use of the NAFORMA data, incorporating biodiversity and carbon sequestration in forestry and forest utilization analysis, and analyzing impacts of various land use policies and climate change mitigations in the Tanzanian forest sector.

Keywords: *Deforestation, land use changes, forest sector model, efficiency, technological change, land degradation, REDD+, bio-economic modelling*



2.1.7.4 Analysis of related policies and legal framework hindering sustainable charcoal value chain promotion in Tanzania

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Abstract

The national clean cooking energy strategy (2024 – 2034) targets to increase use of clean cooking energy to around 80% by 2034. During the transition, it is important to ensure that (i) the production, trade, and use of charcoal is reduced significantly and (ii) the little that will still be in use is produced, traded, and used based on sustainable principles. Supportive policies and legal frameworks need to be in place and enforced. This study reviewed and analyzed related policies and legal frameworks hindering sustainable charcoal value chain promotion in Tanzania to identify gaps, shortcomings, and conflicting areas that require interventions. Methods used include literature review, key informants' interviews and community level discussions with charcoal producers and traders in the districts of Kisarawe and Mkuranga. Collected information was analyzed qualitatively. The study revealed that the Constitution of the United Republic of Tanzania (1977), the National Climate Change Response Strategy (2021-2026), the National Forest Policy of 1998, the Forest Act of 2004, the National Forest Policy Implementation Strategy (2021 – 2031), the National Charcoal Strategy and Action Plan (2021 – 2031) and the National CBFM Action Plan are supportive of sustainable charcoal value chains in the country and can make significant contributions to the realization of the national clean cooking energy targets. The study recommends revision and harmonization of conflicting policies and legal framework. To mention few: (i) The National Forest Policy (1998) and the forest act of 2002 should be revised to foster intersectoral coordination and compliance with sustainable forest management practice; (ii) The National Land Policy, 1995 and the Land Acts of 1999 need to recognise the management of natural woodlands and forests as developments on land; (iii) The Forest Act of 2002 and the Village Land Act of 1999 need to be harmonized to remove the existing ambiguity between “unused land” and general land; and (iv) The National Energy



Policy, of 2015 and its Acts should provide direction and controls on sustainable use of biomass energy sources.

Keywords: *Charcoal, policies, legal frameworks, clean cooking energy*



2.1.8 Forest landscape restoration governance and management

This sub-theme has two keynote speakers and nine paper presenters which in total sum up to eleven presentations. The presenters for this sub-theme are as follow:

	Name	Session No.
Keynote speaker	Silayo, D.A.	18
	Chirwa, P.W.	26
Paper presenters	Njovangwa, G.	25
	Nyarobi, H.A.	25
	Sunagawa, S.	25
	Mangora, M.M.	27
	Mmary, Z.S.	27
	Lorri, P.	27
	Kimani, C.K.	27
	Sangiwa, M.J.	27
	Mbwambo, L.	27



2.1.8.1 Forest landscape restoration governance and management: What is the implication on implementation of FLR Programmes?

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Abstract

This paper examines Africa's pressing socio-environmental challenges, with a focus on forest and land degradation driven by agricultural expansion, overgrazing, and unsustainable charcoal production. These pressures, exacerbated by weak land tenure systems and poor government effectiveness in SLM practices, jeopardize the continent's forests and woodlands, which are essential for ecosystem stability, carbon sequestration, and climate resilience. As a comprehensive response, forest landscape restoration (FLR) is proposed to promote both ecological recovery and socio-economic resilience through practices like natural regeneration, assisted regeneration, and agroforestry. The paper also highlights the dual role of FLR in climate change adaptation and mitigation, with strategies such as REDD+ contributing to greenhouse gas reductions and fostering sustainable management. Addressing policy, tenure, and institutional challenges is identified as key to enabling effective FLR governance frameworks at both local and national levels. Multi-level coordination, policy integration, and equitable benefit-sharing emerge as critical factors in building community trust and commitment to restoration efforts. Additionally, the study explores diverse sustainable land management (SLM) practices, emphasizing locally adapted strategies such as climate-smart agriculture, woodlot establishment, and sustainable charcoal production. Governance pathways that support successful FLR implementation are illustrated with case studies from countries like Ghana and Zambia, where significant farm-based mitigation actions have been realized. In Zambia, initiatives leverage REDD+ and honey production, while Ghana incorporates agroforestry into cocoa landscapes. The study concludes that impactful FLR across sub-Saharan Africa requires diverse, context-specific SLM



strategies, robust local and national policies, and supportive international frameworks, such as AFR100 under the Bonn Challenge.

Keywords: *Climate change, communities, forest and land degradation, institutional frameworks reforestation, policies*

2.1.8.2 Harnessing the role of forest and farm producers in accelerating landscape restoration: A case of dryland and sustainable landscape Impact programme around Miombo woodland of Tanzania

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Abstract

The Miombo woodlands in Tanzania covering about 90% of the total forest cover, represent crucial ecosystems that are experiencing considerable degradation as a result of unsustainable land-use practices. The Dryland and Sustainable Landscapes (DSL-IP) impact programme seek to counter this trend by involving forest and farm producers in restoration initiatives in Sikonge, Kaliua and Mlele Districts. This study examines the role of effective engagement of gender-responsive in Sustainable Land Management (SLM) and Sustainable Forest Management (SFM) in enabling income-generating opportunities and empowers forest and farm producer organisations (FFPOs) in accelerating landscape restoration within the Miombo woodlands, thereby promoting environmental sustainability and enhancing livelihoods. Data were collected through field observations, household surveys, documentary reviews and interviews with local producers by integrating Sustainable Landscapes Production Framework (SLPF), technical support package that incorporates benefits of Forest and Farm Facility (FFF), the Farmer Field Schools (FFS) and Community Seed banks (CSBs). The survey used the Self- evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP+) and a Behaviour Change Assessment. A total of 56 FFPO were assessed, 23 met criteria based on capabilities to manage seeds, natural resources and its enterprises. The findings demonstrate a notable



enhancement in soil fertility improvement and local communities have observed improvements in agricultural productivity and income through the adoption of sustainable practices such as Sustainable Miombo Honey. The study concludes that forest and farm producers are crucial to the success of landscape restoration initiatives in the Miombo woodlands. By integrating traditional knowledge with modern sustainable practices, the programme has achieved substantial environmental and socio-economic benefits. Continued support and active participation of these producers are essential for the long-term success and sustainability of restoration efforts.

Keywords: *Forest, farm producers, sustainable restoration, landscape*

2.1.8.3 Opportunities and challenges in disseminating forestry and beekeeping research results: The Case of academic and research institutions in Tanzania

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Abstract

The effective dissemination of research results is essential for transforming scientific knowledge into actionable policies and practices, particularly in Tanzania's critical sectors of forestry, beekeeping, and environmental conservation. However, there are significant challenges to achieving the widespread dissemination of the research results. This study addresses the gap by exploring how key Tanzanian institutions disseminate research and the obstacles they face in ensuring research reach local communities and informs policy decisions. The objective of the study is to identify the challenges and opportunities for dissemination of forestry and beekeeping research results in Tanzania and provide actionable recommendations for overcoming the barriers. Using a desk review methodology, the study examines dissemination mediums used by ten academic and research institutions, including Tanzania Forestry Research Institute (TAFORI) and University of Dar es Salaam (UDSM). The findings reveal that while institutions employ a variety of dissemination methods



such as digital platforms, community outreach, and policy briefs significant gaps remain in reaching rural communities and influencing policy. Furthermore, opportunities exist to leverage digital platforms, increase government support, and expand partnerships with private sector. However, there are significant challenges to achieving widespread dissemination, including limited digital infrastructure, language barriers and inadequate funding. The study concludes by recommending stronger investments in digital infrastructure, increased financial resources for dissemination activities, and greater communities' involvement in research process to contribute meaningfully to the development of forestry and beekeeping sector and partly contributes to achieving Tanzania's development vision 2025 and Sustainable Development Goals (SDGs).

Keywords: *Research dissemination, forestry and beekeeping, dissemination opportunities and challenges, dissemination mediums*

2.1.8.4 Is *Gmelina arborea* a viable option for timber supply in coastal areas of Tanzania?

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Abstract

With increasing urbanization accompanied by industrial activities along Tanzania's coastline, there is a growing demand for timber and wood products, consequently causing deforestation and forest clearing. *Gmelina arborea*, renowned for its rapid growth and adaptability, offers a promising and sustainable solution to meet this demand. This study investigated the growth performance of *G. arborea* planted under different planting spacings to establish optimal cultivation and management practices to enhance its productivity. A Complete Randomized Block Design was used whereby four treatments (spacing) 2.5 x 2.5m, 2.5 x 3.0m, 3.0x 3.0m and 3.5 x 3.5m were deployed, and replicated four times (blocks). Measurements of Height (m) and Diameter at Breast Height (DBH cm) were taken for all trees. Stand parameters, including tree height, DBH, basal area, tree volume, and mean annual increment (MAI), were computed. Data analysis utilizing R-software featured ANOVA to determine treatment variation and Turkey multiple comparison test to



identify sources of variations. Our results showed significant differences between treatments with trees planted at a spacing of 3.0*3.0m achieved the greatest height and DBH. The overall average height ranged from 4.9 m to 5.7 m, while the average Dbh ranged from 8.6 cm to 9.3 cm. Basal area ranged from 0.065m²/ha to 0.075m²/ha while volume was from 0.38m³/ha to 0.51m³/ha and Mean Annual Increment (MAI) was from 0.064m³/ha/yr to 0.085m³/ha/yr. These results suggest that the spacing is favourable to attaining good wood products based on the growth variable assessed.

Keywords: *Gmelina arborea*, growth performance, spacing

2.1.8.5 Six year growth performance of *Eucalyptus* hybrid clones in Rondo, Tanzania

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Abstract

This study was carried out at Eucalyptus Hybrid Clones trial plots established at Rondo Station in the Kibaha Lowland Afforestation Research Centre in South-eastern Tanzania. Seven Eucalyptus hybrid clones: GC 785, GC 514, GC 584, GC 15, GC 167, GC 940 and GT 529 at the age of six years were selected for assessing their growth performance and adaptability. Seedlings were raised using standard cultural nursery techniques and planted at the beginning of the rain season in 2018. Randomized Complete Block Design (RCBD) was used with spacing between trees was 2.5m * 2.5m across all treatments. A total of 4 blocks, 28 plots with 360 trees per plot were established. The data were subjected to analysis of variance using the Generalized Linear Model (GLM), where the comparison of means were identified using the Duncan Multiple Range test. Early results of survival, growth assessment and performance of the clones were measured. By age six, a significant difference of ($p < 0.05$) were observed among clones and within blocks for all the growth and productivity parameters assessed. Whereby the best performing clonal trait was GC 584 followed by GC 15. For GC 584 was observed to highest mean height and Dbh of 9.2m and 10.5cm



respectively, having high mean annual increment and basal area of 0.18 m²/ha and 0.099m³/ha/yr. The result indicate that all seven clones significantly varied for tree height, DBH, basal area and mean annual increment. Clones such as GC 584 and GC 15 performed superior compare to GC 167, GC514, GC529, GC 785, and GC940 which were statistically significant. Therefore, for the establishment of big plantations in the Southern part of Tanzania these two clones can produce high timber and pole yields and other uses.

Keywords: *Eucalypt clones, growth performance, productivity, survival, Tanzania*

2.1.8.6 Assessment of the effect of membership into the forest farmers' organisations on the livelihoods of smallholder forest farmers in Kilolo District, Tanzania

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Abstract

Membership into the forest farmers' association is a very important tool used by forest farmers to deal with overall socio-economic challenges faced by forest farmers across the globe. The study was conducted to examine the effect of forest farmers' membership to their livelihood in comparison to the non-members. Data were collected using household questionnaires. Data were analysed using SPSS version 26 for descriptive statistics, cross-tabulation, and inferential statistics. Chi-square test results showed that most of the parameters in perceptions of farmers regarding membership in associations, livelihoods assets, strategies employed by forest farmers, challenges faced by farmers solutions variables to be significant at $p < 0.01$, $p < 0.05$ and $p < 0.1$. Model analysis results showed significance for both binary and multinomial logistic regression at $p < 0.01$. Binary logistic regression analysis model have shown significance at $p < 0.01$, $p < 0.05$ and $p < 0.1$ for respondent's sex (male), house wall material, total annual income, income from crop cultivation, secondary education, college education, farm size and private



farm ownership with 2LL $R^2 = 0.727$ (Nagelkerke), Omnibus test significance 0.000, $\text{Prob}>\text{Chi}^2(10) = 76.002$, Number of Observations = 101, Hosmer & Lemeshow test $\text{Prob}>\text{Chi}^2(8)$ with Sign. 0.950. The results from multinomial logistic regression posted a goodness of fit of Chi-square of 64.466 (Pearson) and Pseudo R^2 of 0.758 (Nagelkerke) with degree of freedom of 164 in the likelihood ratio test at 1 percent level of probability. The conclusion of this study is that the livelihood of smallholder forest farmers differs significantly in sex, total annual income, income from crop cultivation as other activities alternative to tree planting, secondary education, college education, and house wall material made of burnt bricks compared to mud bricks, farm size and private farm ownership according to the results output of binary and multinomial logistic regression. More studies on the exploration of the dynamics of forest farmers' associations' membership in southern highlands in general are recommended.

Keywords: *Membership, forest farmers' associations/organisations, no-members, perceptions, assets and strategies*

2.1.8.7 Forest governance research in Tanzania: Analysing social and epistemic patterns in scientific publications

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Abstract

Tanzania is endowed with a number of forest research organisations producing scientific knowledge on forest governance and management that is not only



relevant for national and local policy making but potentially holds valuable insights for the international forest science community. However, as highlighted by science studies, African researchers face significant barriers in publishing and are confronted with the challenge of making choices: what topics to study, which methods to use, for what purpose to frame their findings, which outlets to publish in, etc., in order to remain visible and relevant in their field. Given the significance of locally produced knowledge at the international level, we explore whether and how locally published forest governance scholarship by Tanzania-based scholars differs from ones published in international outlets, and how these differences relate to the author's social position (e.g., gender, collaborators, funding opportunity). We employed a combination of bibliometric and content analysis for 44 publications on the topic of community/participatory forestry by one or more Tanzania-based authors between 2005 and 2021. The results indicate that locally published research is compatible with international ones regarding methods and the purpose of study, although female authors are underrepresented in both. At the same time, we found that locally produced research provided results linking closely with national policies and covered a different geographical scope within Tanzania, paralleled by different patterns of co-authorship and funding. These results imply that if researchers and policymakers survey the forest governance knowledgebase primarily through digitized 'international' science databases, they are likely to miss relevant forest governance research. This has implications for both individual scholars and the forest governance community as a whole, as it reproduces the current barriers in publishing for Tanzania-based scholars and limits the diversity of knowledge utilised to advice international policies relevant for Tanzania.

Keywords: *Forest governance, knowledge production, inequalities, publishing, Tanzania*

2.1.8.8 Mapping Mangrove forests of Tanzania

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Abstract

Despite the existence of policy and legal instruments that govern mangrove conservation and management in Tanzania, deforestation and loss continue to be observed throughout the country. Primary drivers of change are associated with human pressures. These include uncontrolled conversion into other land uses like agriculture, aquaculture, salt making, settlements, infrastructure and property development and logging activities. The mainland Tanzania developed its first mangrove management in 1991 when the mangrove extent was estimated to be 115,500 ha. This was later updated to about 158,100 ha by the NAFORMA project in 2015. Zanzibar has not developed a mangrove management plan, although the mangrove extent was first reported in 1949/1950 to be about 18,000 ha, which was updated in 1997 to 19,748 ha and in 2013 to 16,488 ha through the wood biomass surveys. This paper presents new data on the changes in the mangrove extent between 1990 and 2023 using integrated analyses of historic and contemporary mangrove resources for both the mainland Tanzania and Zanzibar. This assessment employed a combination of digitization of the 1989 inventories (for mainland Tanzania), analysis of historical satellite imagery from Landsat and the current Sentinel imageries using machine learning Google Earth Engine (GEE) in generating the training and validation ground control points. Field validation was conducted using mobile application Survey123 and a feedback tool with editable polygon drawing capabilities. These online apps were built on ESRI and ArcGIS Portal of WWF. For mangrove classification, the supervised Random Forest Modelling and local expert knowledge was applied to map changes in the extent of mangrove forests. This derived an overall accuracy of 90% for 1990 and 94% for 2023. Results indicate that for mainland Tanzania mangrove extent in 1990 was about 124,022 ha and 106,054 in 2023. Mangrove extent that remained stable was 93,761 ha, gained area of 12,292 ha and lost area of 30,261 ha. This represents a net loss of 17,969 ha (14.5%) over 33 years, translating to 545 ha (0.4%) of annual loss. For Zanzibar, mangrove extent in 1990 was 17,354 ha and 13,410 ha in 2023, distributed approximately by 4,146 ha (31%) and 9,264 ha (69%) for Unguja and Pemba, respectively. Mangrove extent that remained stable was 12,564 ha, gained area of 856 ha and lost area of 4,790 ha. This represents



a net loss of 3,944 ha (23%) over 33 years, translating to 120 ha (0.8%) of annual loss. These findings indicate substantial losses that should be taken into consideration to inform the ongoing processes of preparation of the national mangrove strategy and management plans for mainland Tanzania and makes a call to action for preparation of mangrove strategy and management plan for Zanzibar.

Keywords: *Mangrove degradation, mangrove extent, mangrove management plan, mainland Tanzania, Zanzibar*

2.1.8.9 Advancing tree improvement in East Africa: A look at Tanzania's Collaborative Trial Program (TIRWG)

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Abstract

Commercial Forestry provides a myriad of invaluable benefits, from supporting soil health, to mitigating the impacts of climate change, all the while generating over \$700 million USD annually across the East Africa region. However, the sectors' growth remains limited by quality of genetics available to growers with available genetics dating back to pre-millennium in improvement. For this reason, in 2014, Gatsby Africa supported the establishment of the Tree Improvement Research Working Group (TIRWG) in Tanzania. A total of 76 site species trials were established across Tanzania as a result, covering cool temperate, warm temperate, sub-tropical and tropical sites, and considering a diversity of end uses, ranging from poles, sawn timber, veneer and plywood to bioenergy and essential oils. Species categories included Eucalyptus, Corymbia, and Pines together with their hybrids. Trial assessments were carried out from the first year, with a major assessment happening at mid-rotation (which is 5 years for Eucalyptus and 8 years for pines). For eucalyptus, the GxU (*Eucalyptus grandis* X *Eucalyptus urophylla*) and SxU (*Eucalyptus saligna* X *Eucalyptus urophylla*) clonal hybrids performed particularly well, delivering over 30% more growth over 5 years than the control pure species seedlings. For pines, the *Pinus patula* x *Pinus tecumanii* low (PxTeCL) hybrids outperformed pure species pine by an average of 39%, but



volume differences jumped to 114% in sub-tropical sites. PxTecL also had a much stronger survival rate, sitting at 90% compared to *P. Patula*'s 54%. The *P. elliottii* x *P. caribaea* H hybrids also outperformed *P. caribaea* H pure species by over 34% in volume, exhibiting far better stem properties and growth characteristics. The study showed select *Pinus maximinoi* seed sources are also worth considering. The results demonstrated the capacity of tree improvement to drive growth across the sector.

Keywords: *Tree improvement, species trials, genetics, volume, commercial forestry*

2.1.8.10 Effectiveness of assisted natural regeneration approach in achieving landscape restoration: A case of Miombo woodland restoration in Tanganyika District, Tanzania

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Abstract

Assisted Natural Regeneration (ANR) is an effective ecological approach for restoring degraded landscapes, particularly in tropical woodland ecosystems such as the Miombo woodlands of Tanzania. Vital for biodiversity, climate regulation, and local livelihoods, Miombo woodlands are threatened with deforestation and degradation due to factors such as agriculture, woodfuel extraction, overgrazing, and wildfires. We undertook a study to evaluate the effectiveness of a five-year ANR project aimed at restoring Miombo woodlands in three villages in Tanganyika District, Tanzania. Using purposive sampling, circular plots of 0.07 hectares were established to monitor changes in tree density and the recruitment of seedlings, saplings, and coppices. Results indicate a significant increase in tree density across all villages from the 2021 baseline, with over 1.4 million trees recruited into the tree class (DBH \geq 5 cm). Most recruited trees (86%) were from coppicing, while



18.8% originated from seedlings and root suckers, surpassing the target density of 5%. An average coppicing rate of 87.6% was recorded, underscoring the effectiveness of the regeneration processes. Additionally, the assessment documented a notable return of wildlife, including sightings of common duiker and bushbuck, indicating the restored forests are providing suitable habitats for biodiversity. Satellite imagery further illustrated a significant increase in vegetation cover between 2021 and 2024, highlighting substantial progress in restoration efforts. Community engagement and monitoring practices proved to increase tree density and wildlife return. The ANR approach has added benefits such as improved grazing and wildfire management. The project demonstrated that ANR is an effective way to improve landscape, forest conditions and biodiversity quickly while addressing livelihood challenges. We recommend that many more degraded landscapes should be put into ANR to achieve ambitious AFR100 and other national and regional goals.

Keywords: *Assisted natural regeneration, coppicing, degradation, Miombo, restoration*

2.1.8.11 Forest Landscape Restoration in Tanzania: WWF Tanzania ground experience

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Abstract

Forest landscape restoration is not just about planting trees, it is about restoring ecological functions across all landscapes and enhancing human well-being across deforested and degraded landscapes, so that people and nature can thrive together. Landscape restoration in Tanzania is one of the old practices that have been practiced at sector level without considering the entire landscape. In recent years, science has transformed restoration to consider a landscape restoration approach and become more inclusive in addressing environmental problems. This paper presents WWF on the ground experience on FLR through examination of



global policies and initiatives, historical restoration best practices, national FLR processes, the WWF on the ground restoration achievements and lessons learned.

Keywords: *Restoration, landscapes, ecological functions*



2.2 Poster Presentations

2.2.1 Vegetation recovery following flowering and massive death of bamboo in the Udzungwa Scarp Forest Reserve, Iringa, Tanzania

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Abstract

The study aimed to determine changes in both density and basal areas of individuals in tree patches, live and dead bamboo habitats. Results have shown that pioneer tree species are dominating in areas of dead bamboo. Currently few newly bamboos are growing from seeds in areas with dead bamboo and tree patches. This is contrary to what was observed in the first assessment, because regeneration was by then dominated by *Psychotria goetzei*, *Macaranga kilimandscharica* and *Dombeya burgessiae* without bamboo. Despite a significant increase in density of tree regenerants, competition from biennial grasses and shrubs which form dense cover and thickets limits recovery of both trees and bamboo regenerants. The presence of dense cover has also contributed to inaccurate estimation of density of regenerants which forms the future forest. It is also interesting to note that tree species like *Psychotria goetzei*, which has very high regeneration do not appear among the canopy tree species therefore it is not expected to compete with other fast growing tree species and bamboo. It is therefore recommended that, conducting of enrichment planting from the observed fast growing tree species in all open areas is imperative. These species are *Macaranga kilimandscharica*, *Dombeya burgessiae*, *Polyscias fulva*, *Albizia gummifera* and *Cassipourea gummiflua*. As the bamboo species in UPNR is regenerating from seeds, it could be good to enhance its natural recovery. To avoid unexpected vegetation recovery and reduction of biodiversity due to alien invasive species, it is important to continue conducting monitoring of vegetation in the area.



Capacity building on domestication of bamboo and other indigenous tree species which are mostly utilized as building material is also emphasized.

Keywords: *Vegetation recovery, bamboo, Uzungwa nature reserve, eastern arc mountains, plant regeneration*

2.2.2 Capacity building and partnerships for co-creation of knowledge and skills to build climate resilient forestry: Kenya-Japan 4 decades of partnership experience

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Abstract

Sub-Saharan African (SSA) countries are rich in biodiversity and have diverse ecosystems. However, these countries face significant environmental challenges mainly due to climate change, and landscape degradation. These challenges lead to low land productivity, biodiversity loss and desertification. These challenges transcend geographical boundaries and there is need to build partnerships for knowledge co-creation, wide scale information sharing and technology transfer to collectively address these problems within Africa. However, these challenges are exacerbated mainly by: over reliance on forest and woodlands for livelihood needs, poor land use systems, inadequate scientific information and technical knowledge on; tree species-site matching tree establishment and management techniques; and inadequate impactful extension approaches to enhance adoption of existing technologies. Over the last four decades, Kenya Forestry Research Institute (KEFRI) in collaboration with Japan International Cooperation Agency (JICA) has undertaken research and development work in dryland forestry research on; species and provenance trials, tree seed technologies, tree nursery development for Arid and Semi-arid Lands (ASAL) species; techniques and practices for tree establishment and management; on-farm tree planting verification and promotion; and *Melia volkensii* development and improvement. Strategies for knowledge sharing through piloted extension approaches were



promoted, and capacity building for technical officers, extension agents and farmers in Kenya and 21 SSA countries undertaken. To promote targeted and capacity building for SSA countries was done under the Third Country Training Programme (TCTP) which evolved in scope to address emerging challenges in Natural Resource Management (NRM) that included: low awareness and adoption of proven nature based solutions and technologies, and climate change mitigation and adaptation measures. It is anticipated that information on four decades of KEFRI/JICA collaboration will provide research and development approaches, share knowledge on nature-based solutions for targeted and impactful landscape restoration in Africa.

Keywords: *Capacity building, knowledge co-creation, partnerships*

2.2.3 Forest degradation, conservation, and nature based solutions

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Abstract

Forest degradation poses a critical threat to global biodiversity, disrupting ecosystems and diminishing essential services that forests provide, such as carbon sequestration, water regulation, and habitat for species. The loss of biodiversity as a result of deforestation and degradation not only undermines ecological resilience but also exacerbates climate change and reduces the ability of ecosystems to recover from environmental stresses. Conservation efforts, focusing on protecting and restoring forest ecosystems, are increasingly necessary to halt these trends. Nature-based solutions, such as reforestation, afforestation, and sustainable forest management, offer viable pathways to mitigate forest degradation and preserve biodiversity. These approaches work in harmony with natural processes, ensuring long-term ecological balance while contributing to climate change adaptation and mitigation. In the context of global environmental sustainability, it is essential to implement integrated strategies that prioritise both the protection of biodiversity and the rehabilitation of degraded forest landscapes, fostering resilience and sustainability for future generations.



Keywords: *Forest degradation, biodiversity, afforestation, ecological resilience, environmental sustainability*

2.2.4 Factors influencing the adoption of modern beehives in Sikonge District, Tabora, Tanzania

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Abstract

Choices made by a beekeeper to use modern beehives depend on various factors. This study assessed the factors influencing adoption of modern beehives in Sikonge District. Data were collected by semi-structured questionnaire, key informants interview and focus group discussion. This study was done in four wards; Chabutwa, Tutuo, Kipanga and Kiloleli, which were randomly selected out of the 15 wards of Sikonge District. Descriptive statistics and binary logistic regression were used as analytical tools. Binary logistic regression model revealed that factors which statistically affect the adoption of modern beehives are gender of the household head ($p < 0.05$), affiliation of a beekeeper to beekeeping group ($p < 0.001$) and experience in beekeeping ($p < 0.001$). It is recommended that beekeepers in the study area be encouraged to develop and join beekeeping groups so as to improve the adoption.

Keywords: *Beekeeping, beehives, adoption, Sikonge District, binary logistic regression*



2.2.5 Resource use efficiency in beekeeping using modern beehives: A case of Sikonge District, Tabora, Tanzania

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Abstract

This study revealed detailed information concerning resource use efficiencies using modern beehives essential in planning to improve yield and profit of beekeeping in Sikonge District. Choices made by a beekeeper to use what and how much resources in beekeeping vary among beekeepers basing on availability of the resource itself. This study analysed the resource use efficiency in beekeeping activities in Sikonge District. The specific objective for this study was to evaluate resource use efficiency of beekeeping using modern beehives. Data was collected by semi-structured questionnaire, key informants' interview, focus group discussion and direct field observation. This study was done in four wards; Chabutwa, Tutuo, Kipanga and Kiloleli. The wards were randomly selected out of the 15 wards of Sikonge District. Descriptive statistics were obtained using Statistical Package for Social Science (SPSS) computer programme as analytical tool. Results revealed that the number of beehives and number of man-days for hired labour were underutilised with resource use efficiency coefficient (r) values of 1.5 and 121 respectively while family labour man-days were overutilised ($r = -91.82$). It is recommended that beekeepers in Sikonge utilize the available resources optimally to maximize yield and profit of their beekeeping activities.

Keywords: *Efficiency, beekeeping, modern beehives*



2.2.6 The role of timber agroforestry in the livelihood of rural Tanzania

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Abstract

In the context of increasing climate change threats, restoring forests for watershed conservation, ecosystem preservation, and the sustainable supply of forest products is a critical task. Recently, smallholder-led reforestation has been reported primarily in tropical regions (Ota et al. 2020; Kimambo et al. 2020). Similarly, in Tanzania, smallholders engage in reforestation. In rural areas of the East Usambara Mountains in North-eastern Tanzania, smallholders integrate *Cedrela odorata*, a timber species, into fields where they cultivate fruit trees, spices, and root crops, to sell the wood. This study aims to clarify the role of timber tree planting in the livelihood activities of rural households in the East Usambara Mountains, North-eastern Tanzania. Specifically, the study selected village K in the East Usambara Mountains as the research site and randomly sampled 23 household heads as respondents. Semi-structured interviews, GPS-based field measurements, and tree surveys were conducted with the selected households. All 23 surveyed households had planted *C. odorata* in their fields, with an average of 59.7 trees per household and a median of 36. The timber species was intercropped with fruit trees, spices, and root crops. The main difference between crops and timber in rural livelihood activities is the time to harvest and the presence or absence of a specific harvest season. In this region, income is categorized into "seasonal income," which comes from spices like pepper harvested at specific times, and "daily income," from activities like selling bananas or casual labour. While *C. odorata* requires about eight years to mature, it demands little labour and can be sold to intermediaries anytime after reaching maturity. Thus, timber sales contribute to daily income, particularly helping farmers manage unexpected expenses in their everyday lives.

Keywords: *Timber, Cedrela odorata, small scale holder, income*



2.2.7 Ecological impact and spatial distribution of invasive species *Prosopis juliflora* across Northern Tanzanian landscapes

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Abstract

Prosopis juliflora, commonly known as Mesquite, is an invasive species that poses significant ecological and socio-economic challenges in arid and semi-arid regions worldwide. Understanding its population density, distribution, and impact is crucial for developing effective management strategies. This study aimed to assess the population density, distribution, and ecological impact of *P. juliflora* in Northern Tanzania. The specific objectives for this study were to i) quantify the density of *P. juliflora* across wards and land use types, ii) analyze its diameter size distribution, iii) comparing forb and grass richness, Shannon diversity index, abundance, and cover in areas not invaded and invaded with *P. juliflora*, mapping its spatial distribution, and iv) evaluating the environmental and anthropogenic factors influencing population density of *P. juliflora*. Data were collected through line transects and quadrants to record the presence and density of *P. juliflora* across wards and land use types. Descriptive statistics were employed to summarize abundance, density, and basal area of *Prosopis juliflora* across wards and land use categories. Wilcoxon test was used to determine whether forb and grass richness, Shannon diversity index, abundance, and cover varied between not invaded sites and invaded sites. Negative Binomial Regression was employed to examine the influence of environmental variables on population density of *P. juliflora*. The study revealed significant variability in *P. juliflora* population densities across wards and land use types, with settlement areas and grazing lands showing the highest densities. The population structure analysis indicated that most *P. juliflora* trees are in smaller diameter classes, suggesting young populations with a high potential for further spread. The findings underscore the need for targeted management strategies to control the spread of *P. juliflora* in Tanzania. The species' adaptability to various environmental conditions and its impact on native ecosystems necessitate ongoing monitoring and intervention to mitigate its adverse effects.

Key words: *Diameter classes, ecological impact, prosopis juliflora, spatial distribution*



2.2.8 Existing management approaches are not scalable in the fight against the globally invasive tree *Prosopis juliflora*: A review

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Abstract

Prosopis juliflora is an invasive tree originating from Central and South America, is ranked among the world's 100 most harmful invasive species, severely impacts biodiversity, soil chemistry, human livelihoods, and poses health risks, potentially endangering native species. Despite global efforts to control this species using mechanical, chemical, biological, and integrated methods, it continues to spread, suggesting current strategies are ineffective. This review evaluates the effectiveness of various management approaches and highlights challenges and lessons from global experiences. Findings reveal that management efforts have mostly been small-scale trials, with mechanical, chemical, biological, and integrated methods applied at 12%, 38%, 12%, and 17% scales, respectively. These strategies often fail due to their unsustainability, lack of follow-up, and poor documentation of scalable protocols. *Prosopis juliflora*'s adaptability to diverse environments further complicates management. The review underscores the urgent need for sustainable strategies that account for environmental factors and community perceptions. It recommends developing tailored management plans for each country, raising awareness in affected regions, and integrating various control methods to improve effectiveness.

Keywords: *Prosopis juliflora*, invasive species, integrated approach, management strategies, sustainability



2.2.9 Foliar nutrient concentration in first and second rotations of *Pinus patula* at Sao Hill forest plantation in Tanzania

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Abstract

Foliar nutrients status can be used to determine soil nutrient supplying potential and plant nutrient deficiencies of the site. This study examined the foliar nutrients status of *Pinus patula* in first and second rotation stands in Sao Hill forest plantation, Tanzania. Stratified sampling was used where four locations (Blocks) with 8 compartments with two treatments (PPR1 and PPR2) were randomly selected. The sampling units were plots with eight trees with larger, medium, and lower sizes selected for foliar sampling. Ten (10) quadrant plots measuring 20 m x 20 m (400 m²) per compartment were laid out at different slope positions following the contour at an interval of 100 m along. From each plot, green needles (GN) were sampled from the middle crown position and senescent needles (SN) were sampled in the lower crown from eight (8) trees tagged with ribbons. Foliage samples were collected during dry and wet seasons and analysed for macro nutrients. Results showed nutrients concentrations varied with rotations and were mostly within the range of critical levels except Phosphorus which was low implying lower uptake due to low soil Phosphorus availability, probably attributed to low soil pH. Foliar Nitrogen concentration was significantly higher during the wet season compared to other nutrients increased ($p < 0.001$) during the dry season. Foliar Nitrogen, Phosphorus, Potassium, Calcium, Magnesium concentrations and NP ratio were significantly higher ($p < 0.0001$) in PPR1 than PPR2 stands. These contrasting results imply that the increase in rotation negatively affected foliar nutrient concentration in *Pinus patula* at Sao Hill forest. The findings can be used as data base for foliar nutrients status and the basis for improvement of management practices in the plantation. The study recommended improvement in management practices by retaining foliage in the field during harvesting for better nutrient cycling and avoid burning of log trashes.

Keywords: *Foliar nutrients concentration, nutrient resorption, Sao hill, Pinus patula rotations*



2.2.10 A contested terrain of accountability, meaning, systems and processes. Experience of Polycentric forest governance in Tanzania

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Abstract

This article examines the influence of the different meaning attached to, the system and processes of accountability on performance of Polycentric system in forest management. We argue that clearly understanding of what it means to be accountable, and the embedded systems influence governance efficiency Polycentric governance represents a multifaceted approach in managing forest landscape where multiple centres of decision making exist at different levels and has shown to enhance performance. Among the challenges that has been put forward in implementing the polycentric governance system is on conceptual understanding of what accountability entails, how to effectively ensure accountability in the multitude of actors involved in management. Questionnaire surveys have been conducted among the 12 institutions involved in forest management in Kilwa and Mtama districts. Similar information was collected among heads of household of forest adjacent communities where forest is managed by various institutions at different level. Results indicates different meanings are attached to being accountable 50% reported attending village meetings, 14% responding to community needs, 14.3% conducting feedback meetings and 14.3% attending village meetings, responding to community needs and conducting feedback meetings all together. Results on the available accountability systems indicates 21.4% reported monitoring and evaluation meetings, 28.6% reporting on activities conducted whereas 51% reported management meeting. The efficiency of accountability system was rated at 28%, 21% and 51% respectively. Similarly results on the three processes of accountability of individual institutions indicate varying degrees of accountability with the non-state actors leading in accountability levels The results indicate different meanings, systems and processes of accountability in forest management bringing in both opportunity and challenges in effecting forest management. This call for common understanding among institutions in forest



management and establish accountability criteria and enhance mechanism of oversight and transparency within state accountability structures

Keywords: *Polycentric forest governance, accountability, management, actors and forum*

2.2.11 Appropriate volume of beehives in Semi-Arid Areas of Dodoma, Tanzania

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Abstract

The volume of beehives significantly affects honey yield, hive occupation, honeybee behavior, and pest management. However, there has been no prior research determining the optimal hive volume for the semi-arid regions of Tanzania, specifically in Dodoma, where cases of bees occupying residential premises are prevalent. This study aimed to identify the suitable hive volume for the semi-arid areas of Kongwa and Chamwino Districts in Dodoma. The objectives included revisiting the volumes of beehives currently in use, assessing honey yield from different hive sizes, and identifying potential bee forage in the region. A preliminary study in 2022 involved sampling of 30 prominent beekeepers to examine existing hive volumes. Five hive volumes—78 Litres, 70 Litres, 62 Litres, 43 Litres, and 29 Litres—were tested, each with three replicates of frame and top bar hives. Data collection was primarily through direct observation and measurement, focusing on hive volume, honey yield, hive preference, and swarm cell presence. Mellisopalynology was utilised to identify potential bee forage. Results indicated that beekeepers in the study area use hives with volume ranging from 83 Litres for box hives to 20 Litres for log hives. The average honey yield was highest (21.23 kg) in the hives with 78 Litres, which showed no swarm cells, while the 62 Litres hives yielded the least and had swarm cells present. Hives with top bars were occupied first, regardless of whether frame hives were present. Key forage sources were identified across ten families, including Acanthaceae and Fabaceae. In conclusion, the study recommends constructing frame and top bar



hives at a volume of 78 Litres to optimize honey production in the semi-arid regions of Chamwino and Kongwa Districts in Dodoma, Tanzania.

Keywords: *Apis mellifera, beehive, Dodoma, honey-yield, volume*

2.2.12 First record of thermophilization in the Afromontane forests of Viruga Mountains in Rwanda-Uganda-DRC Congo and Udzungwa Mountains in Tanzania

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Abstract

Thermophilization of plant communities (i.e., directional changes in composition towards greater relative abundances of species associated with warmer environments) is well-documented in the Neotropics, but it is uncertain whether



this phenomenon also occurs in tropical Africa, where lower tree diversity and different biogeographic history could affect species' responses to climate change. Here we use re-census data from 17 forest plots spread across three mountain regions of Africa to show that thermophilization is widespread. Mean rates of thermophilization [thermal migration rate (TMR)] across all censuses were $+0.0082$ °C·y⁻¹ in the Kigezi Highlands (Uganda), $+0.0028$ °C·y⁻¹ in the Virunga Mountains (Rwanda-Uganda-DR Congo) and $+0.0012$ °C·y⁻¹ in the Udzungwa Mountains (Tanzania). Unlike in the Andes, recruitment was an important component of thermophilization in the African plots, indicating that the observed shifts were attributable to both range shifts and contractions. The African montane forests studied currently act as a carbon sink but changes in species composition may imperil this vital ecosystem function.

Keywords: *Afromontane forests, thermophilization, Viruga Mountains, Udzungwa Mountains*



3.0 CONFERENCE EXHIBITORS

The conference participants include exhibitors from both government and private organisations as shown in the table below:

S/n	Name	Exhibition Products
1	Forest and Beekeeping Division (FBD)	Forest and beekeeping products
2	Tanzania Forestry Research Institute (TAFORI)	Forest and beekeeping products
3	Tanzania Forest Services (TFS) Agency	Forest and beekeeping products
4	Tanzania Forest Fund (TaFF)	Success stories on forest and beekeeping projects
5	Ngorongoro Conservation Area Authority (NCAA)	Wildlife products and tourism packages
6	Finland Embassy	Success stories from forest and beekeeping projects
7	World Wide Fund for Nature (WWF) Tanzania	Success stories from biodiversity projects
8	Tanzania Wildlife Research Institute (TAWIRI)	Wildlife products
9	Sun King	Renewable energy solutions
10	United States Agency for International Development (USAID)	Success stories from a vast population that got assistance from USAID
11	ENABEL	Beekeeping products
12	College of African Wildlife Management (CAWM)	Wildlife products



13	Tanzania Association of Tour Operators (TATO)	Tourism guideline and places to visit for relaxations and touring
14	Eastern Arc Mountains Conservation Endowment Fund (EAMCEF)	Projects' success stories from the Eastern Arc Mountains
15	Kijiji cha Nyuki Company Ltd	Beekeeping products
16	Beekeeping Training Institute (BTI)	Beekeeping products
17	Forestry Training Institute (FTI)	Forest products
18	Forest Industries Training Institute (FITI)	Forest products
19	Kenya Forestry Research Institute (KEFRI)	Forest products
20	TaTEDO-Sustainable Energy Services Organisation (TaTEDO-SESO)	Clean energy solutions
21	Sustainable Energy Services Company Limited (SESCOM)	Renewable energy solutions



4.0 KEYNOTE SPEAKERS BIOGRAPHS



Prof. Verdana Grace Masanja
Nelson Mandela African Institution of Science and Technology (NM-AIST)
&
Chairperson of the Board of Directors
Tanzania Forestry Research Institute (TAFORI)

Professor Verdiana Grace Masanja is a distinguished mathematician and leader in STEM with a substantial impact across academia and gender equity initiatives. Currently a Professor at Kampala International University in Tanzania (KIUT) and Professor Emerita at Nelson Mandela African Institution of Science and Technology (NM-AIST), she holds key roles at NM-AIST, including Deputy Leader of the Data-Driven Innovation for Food and Nutritional Security Incubation Centre, Chairperson of the Mathematical Modelling and Computational Science Research Group, and Principal Investigator of the WOLIMODS project, a collaboration of six universities from Finland and Africa. Professor Masanja teaches master's and PhD courses, currently supervising 7 master's and 10 PhD students. With over 47 years in academia, she has been a Full Professor since 2006, and her work spans multiple countries, including Tanzania, Rwanda, Germany, Finland, Kenya, and Uganda. She has supervised 20 master's, eight PhD, and two postdoctoral students. Her research focuses on computational modeling, especially in epidemiology, disease modeling, optimization, and environmental science, emphasizing projects that address real-world issues and involve artificial intelligence and cross-disciplinary collaboration. In addition to her academic roles,



Professor Masanja chairs the Tanzania Forestry Research Institute (TAFORI) Board and is Vice President of the Africa Mathematical Union (AMU) for Eastern Africa. She also serves on the Basic Sciences Committee of COSTECH. Her leadership contributions at NM-AIST include guiding task forces to develop strategic and quality assurance policies. As a strong advocate for women in STEM, Professor Masanja has received numerous awards, including the NEF Sage Women in STEM award. She was the first Tanzanian woman to earn a PhD in mathematics, setting a pioneering example in her field. Her career includes 28 impactful projects, 127 extensive publications, and roles as an author and editor, advancing STEM capacity, research, and gender equity across Africa.





Prof. Dos Santos Silayo
Conservation Commissioner
Tanzania Forest Services Agency (TFS)

Prof. Dos Santos Aristaricky Silayo is the Conservation Commissioner – Tanzania Forest Services Agency (TFS). He is a member to various Board Committees including the Board of Directors of the Tanzania Forestry Research Institute (TAFORI). Before being appointed as Conservation Commissioner, Prof. Dos Santos worked with Sokoine University of Agriculture (SUA) at the Department of Department of Forest Engineering and Wood Science. He is a Professor in forestry science specializing on forest engineering. He has done various research studies in the field of forest engineering as well as biodiversity conservation. He was also involved in REDD+ piloting projects in Tanzania.





Dr. Mike Allsopp
Head of the Agricultural Research Council's Bee Research Unit
Stellenbosch University

Mike Allsopp has 40 years of experience in bee research and is head of the Agricultural Research Council's Bee Research Unit in Stellenbosch. He is currently South Africa's only honeybee researcher outside of academia, and he is also the leading authority on South African honeybees in agricultural settings. Mike has a very strong passion for bee farming and he is among the few bee specialists that are exploring various opportunities to make bee farming a success conservation industry in sub-Saharan Africa. He has published widely on the influence and impact of honey bees on food production. Apart from winning a worldwide recognition on bee farming, Mike has also played a very important role in ensuring that indigenous knowledge on bee management and honey bees habitats are protected despite the increasing pressure of converting natural vegetation for agriculture and settlements.





Prof. Suzana Augustino
Deputy Vice Chancellor Planning, Finance and Administration
Nelson Mandela African Institute of Science and Technology (NM-AIST)

Prof. Suzana Augustino is a distinguished academic leader and is the current Deputy Vice Chancellor Planning, Finance and Administration at the Nelson Mandela African Institute of Science and Technology (NM-AIST). Apart from the administrative position, Prof. Suzana has been involved in forestry and beekeeping research activities in gender perspectives. She has also been involved in research related to climate change adaptation in the country as well as medicinal plant parts and practices used by communities around the miombo woodlands.





Ms. Gisela Ngoo
Gender and Energy Expert
Tanzania Association of Clean Cooking Stakeholders

Ms. Gisela Ngoo, is a Gender and Energy Expert, working with and Non-Governmental Organisation (NGO) known as the Tanzania Association of Clean Cooking Stakeholders. She has over 16 years' experience in the gender and energy fields in Africa, particularly in gender analysis and mainstreaming in energy, women empowerment in productive use of energy and engagement with local communities, private - solar mini-grid projects, developers, energy and non-energy government entities and civil societies. Ms. Gisela, is a graduate with an MSc. in Forestry from Sokoine University of Agriculture in Tanzania.





Prof. Paxie Wanangwa Chirwa
Forest Science in the Department of Plant and Soil Sciences
University of Pretoria

Prof. Paxie Wanangwa Chirwa is a Professor of Forest Science in the Department of Plant and Soil Sciences at the University of Pretoria. He is also a Forest Chair for the Forest Science Postgraduate Programme in the Faculty of Natural and Agricultural Sciences at the same university. His expertise lies in socio-ecological systems in forests and resource use in agroforestry systems. Prof Chirwa works in different forest ecosystems in Africa, including the Miombo dry forests and woodlands of Southern Africa. He has supervised over 24 PhDs and 43 Masters Students. His scholarly contributions include publication of over 150 scientific articles in peer-reviewed international journals; 21 Book Chapters and Edited 3 Books. He has acted as Guest editor for three special issues of forestry journals; the International Forestry Review, Agroforestry Systems, and the Southern Forest: A Journal of Forest Science. He recently was one of the co-editors of the book "Miombo Woodlands in a Changing Environment: Securing the Resilience and Sustainability of People and Woodlands by Springer, Cham. https://doi.org/10.1007/978-3-030-50104-4_1 Ribeiro N.S., Katerere Y., Chirwa P.W., Grundy I.M. (eds) (2020).








Dr. Urs Schaffner
Head of the Ecosystem Management Section
Agriculture and Biosciences International (CABI) - Switzerland








Dr. Urs is Head of the Ecosystems Management section at the Centre for Agriculture and Biosciences International (CABI) and is based in Switzerland. Raised as an ecologist, he has more than 30 years of experience in assessing the impacts of invasive species on people and the environment, developing and implementing biological control and other nature-based solutions, and regenerating degraded grasslands in Europe, North America, Asia and Africa. More recently, Urs has led and is leading multi-partner transdisciplinary research-for-development projects in eastern Africa which aim to generate a better understanding of the impacts of invasive trees on social-ecological systems and to implement sustainable land management at the landscape scale to meet the needs of the multiple stakeholders affected. Urs also holds an affiliated assistant professorship at the University of Idaho, USA. He has published more than 200 scientific papers and has been and is acting as an advisor to various national governments in Europe, North America and Africa in matters concerning biological invasions.









5.0 CONFERENCE ORGANIZING COMMITTEE

S/N	PHOTO	PARTICULARS
1		Name: Dr. John R. Mbwambo Designation: Head of Planning and Projects Institute: Tanzania Forest Fund (TaFF) Position: Chairman
2		Name: Mr. Daniel C. Pancras Designation: Assistant Director Beekeeping Development Institute: Forest and Beekeeping Division, Ministry of Natural Resources and Tourism (MNRT) Position: Vice Chairman
3		Name: Dr. Chelestino P. Balama Designation: Director of Forest Utilization Research Institute: Tanzania Forestry Research Institute (TAFORI) Position: Secretary
4		Name: Dr. Nancy E. Pima Designation: Centre Director Institute: Tanzania Forestry Research Institute (TAFORI) Position: Deputy Secretary
5		Name: Mr. Allen K. Richard Designation: Director of Beekeeping Research Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member
6		Name: Dr. Amani J. Uisso Designation: Senior Research Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member









7		<p>Name: Dr. Pilly J. Kagosi Designation: Principal Research Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
8		<p>Name: Dr. Ezekiel E. Mwakalukwa Designation: Senior Lecturer Institute: Sokoine University of Agriculture (SUA) Position: Member</p>
9		<p>Name: Mr. Someni Mteleka Designation: Senior Forest Officer Institute: Tanzania Forest Services Agency (TFS) Position: Member</p>
10		<p>Name: CPA. Nancy Mwakalundwa Designation: Accountant Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
11		<p>Name: Mr. Davis Kiwelu Designation: Information Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
12		<p>Name: Mr. Nassoro Garamatatu Designation: Tourism Officer Institute: Tanzania Tourism Board (TTB) Position: Member</p>
13		<p>Name: Mr. Geoffrey G. Njovangwa Designation: Assistant Lecturer Institute: Tanzania Institute of Accountancy (TIA) Position: Member</p>



14		<p>Name: Ms. Lucy A. Kissima Designation: Library Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
15		<p>Name: Mr. Stanslauss B. Lukiko Designation: Research Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
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17		<p>Name: Mr. Muhidin I. Mwenda Designation: Acting Head of Procurement Management Unit Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
18		<p>Name: Mr. Agrey M. Msukwa Designation: Transport Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
19		<p>Name: Dr. Upendo Msalilwa Designation: Senior Research Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>



20		<p>Name: Mr. Emmanuel Kaale Designation: Head of ICT Unit Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
21		<p>Name: Mr. Shafii Boma Designation: Legal Officer Institute: Tanzania Forestry Research Institute (TAFORI) Position: Member</p>
22		<p>Name: Ms. Pamela S. Bilali Designation: Transport Officer Institute: Ministry of Natural Resources and Tourism (MNRT) Position: Member</p>
23		<p>Name: Ms. Halima F. Hassan Designation: Principal Administrative Officer Institute: Regional Commissioner Office Position: Member</p>
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